United States
Environmental Protection
Agency

Optimization Review Report
Operation and Maintenance Optimization Study

Reynolds Metals Company Superfund Site
Multnomah County, Oregon
EPA Region 10

OPTIMIZATION REVIEW

REYNOLDS METALS COMPANY SUPERFUND SITE, MULTNOMAH COUNTY, OREGON EPA REGION 10

FINAL REPORT
September 2018

EXECUTIVE SUMMARY

NATIONAL OPTIMIZATION STRATEGY BACKGROUND

The U.S. Environmental Protection Agency's (EPA's) definition of optimization is as follows:

> "*Efforts at any phase of the removal or remedial response to identify and implement specific actions that improve the effectiveness and cost-efficiency of that phase. Such actions may also improve the remedy's protectiveness and long-term implementation, which may facilitate progress towards site completion. To identify these opportunities, Regions may use a systematic site review by a team of independent technical experts, apply techniques or principles from Green Remediation or Triad, or apply some other approaches to identify opportunities for greater efficiency and effectiveness*."[1]

An optimization review considers the goals of the remedy, available data, conceptual site model (CSM), remedy performance, cost-effectiveness, technical improvement, and closure strategy. A strong interest in sustainability has also developed in the private sector and within federal, state, and municipal governments. Consistent with this interest, principles of green remediation and environmental footprint reduction are now routinely considered during optimization reviews, when applicable.

This optimization review includes reviewing site documents, interviewing site stakeholders, visiting the site for one day and compiling a report that includes recommendations intended to improve the following:

- Remedy effectiveness
- Technical improvement
- Cost reduction
- Progress to Site closure
- Environmental footprint reduction

The recommendations are intended to help the site team identify opportunities for improvements in these areas. Analysis of recommendations, beyond that provided in this report, may be needed before implementation of recommendations. All recommendations are based on an independent review and represent the opinions of the optimization review team. The recommendations are not requirements; they are provided for consideration by the EPA Region and other site stakeholders. Also, note that while the recommendations provide some details, they do not replace other, more comprehensive, planning documents such as work plans, sampling plans, and Quality Assurance Project Plans (QAPPs).

The national optimization strategy includes a system for tracking the outcome of the recommendations and includes a provision for follow-up technical assistance from the optimization review team as mutually agreed upon by the site management team and EPA Office of Superfund Remediation and Technology Innovation [OSRTI].

[1] EPA, 2012. Memorandum: Transmittal of the National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion. From: James. E. Woolford, Director Office of Superfund Remediation and Technology Innovation. To: Superfund National Policy Managers (Regions 1 – 10). Office of Solid Waste and Emergency Response (OSWER) 9200.3-75. September 28.

SITE-SPECIFIC BACKGROUND

The Reynolds Metals Company (RMC) Site is located one mile north of the City of Troutdale, Oregon. The property is bordered by the Columbia River to the north, the Sandy River to the east, the Troutdale Airport to the south, and Salmon Creek to the west. RMC operated a primary aluminum reduction plant where aluminum was produced from the raw material alumina. Approximately 108 acres of the 800-acre site were occupied by the former plant area. The RMC Site operated under various owners and arrangements from 1941 to the fall of 2000 when the plant was permanently closed. The buildings were demolished in between 2003 and January 2006, and the property was sold to the Port of Portland in 2007.

According to the second Five-Year Review (EPA, 2013), the Remedial Investigation and Feasibility Study (RI/FS) showed high levels of contamination in soil, waste, and debris, and in the North Landfill, the South Landfill, the Scrap Yard, and East Potliner areas. The North Landfill is located to the north of the former plant area in the 100-year floodplain. The South Landfill, Scrap Yard, and East Potliner area are all located in the former plant area referred to as the East Area. High levels of contamination were also identified in the process residue accumulated at the bottom of Company Lake. A fluoride plume in groundwater beneath the RMC facility and extending toward both the Columbia and Sandy rivers is also present. The plume extends from the silt unit near the surface downward through the upper gray sand to the intermediate sand and into the deep sand/gravel as a result of strong downward hydraulic head gradients resulting from pumping of deep sand/gravel production wells.

Approximately 60,000 tons of source material and contaminated soil were removed from various former process areas between 1995 and 2002. Following the issuance of an Interim Record of Decision (ROD) in 2002, over 170,000 tons of additional source material was removed from Company Lake, North Landfill, and South Landfill and sent off site for disposal. Some areas of the North Landfill and Company Lake where contamination was left in place were capped. In 2005, a groundwater remedy was installed to control migration of the fluoride plume. The remedy consisted of groundwater extraction from focused extraction (FE) wells to control contamination migrating downward from the shallow silt unit and extraction from the former production wells in the deep sand/gravel to control contamination already present in the intermediate sands and deep sand/gravel. The extracted water from the two sets of wells is discharged to the Columbia River in accordance with a National Pollutant Discharge and Elimination System (NPDES) permit issued by the Oregon Department of Environmental Quality (ODEQ). The 2006 Final ROD selected a remedy consisting of institutional controls, cap maintenance, monitoring, and continuation of the groundwater remedy to reduce migration of fluoride concentrations to the Columbia and Sandy rivers to protect aquatic ecological receptors and restore the underlying aquifer by reducing fluoride concentrations to below 4 milligrams per liter (mg/L). The silt unit, which has insufficient well yield to serve as a potable water sources, is exempt from meeting the 4 mg/L cleanup standard.

CONCEPTUAL SITE MODEL AND KEY FINDINGS

Fluoride concentration trends in groundwater have decreased in many locations, but current concentrations and trends since source removal activities were conducted and groundwater extraction commenced suggest the remedy will take significantly longer than the 5 to 10 years estimated in the final ROD to meet 4 mg/L in the intermediate sand and deep sand/gravel. Fluoride concentrations at several locations in the intermediate sand remain above 4 mg/L and are increasing in at least one location. Fluoride concentrations are also increasing to as high as 40 mg/L at one of the deep sand/gravel monitoring locations. Based on continued high fluoride concentrations in the silt unit and the upper gray sand, substantial contaminant mass is present in these shallow zones, allowing them to serve as ongoing sources of fluoride contamination to the intermediate sand and deep sand/gravel.

In its current form, remedy operation will need to continue for decades to reach goals, with continued pumping from the former production wells pulling contamination from the shallower zones into the intermediate sand and deep sand/gravel.

Although the development of the NPDES permit considered the effects of the extraction well discharge on aquatic species, it is unclear if the combined effects of ongoing fluoride discharge from groundwater and from the NPDES outfall have been considered. It is also unclear whether the 4 mg/L limit is protective of potential surface water receptors and if the existing system is providing adequate protection.

RECOMMENDATIONS

Optimization team recommendations for the RMC Site are summarized below.

- ***Clarify the remedial approach.*** The remedial approach depends on a number of factors, including the intent of the current FE system, the role of the production well pumping, and the desired time frame for remediation. For example, if the expectation is that groundwater extraction can be discontinued in approximately 10 years, then a more aggressive approach that includes source area remediation will be needed. If the expectation is that the upper gray and intermediate sand aquifers are restored in approximately 10 to 20 years but groundwater extraction will continue for many more years to prevent recontamination from the remaining sources (including the silt unit), then source treatment will not be needed, but enhanced FE will be required to adequately control remaining sources.

- ***Revisit potential ecological risk due to fluoride contamination of surface water and the role of the PWO system.*** The flux of fluoride to the Columbia and Sandy Rivers is not currently known, and it is unclear if the current flux of fluoride to the rivers is protective of the wildlife receptors in the rivers. Furthermore, the effectiveness of the PWO system in reducing that flux or the even the need for the PWO system to have a protective remedy is not well established. A number of studies at the Site are ongoing to evaluate the flux of fluoride and aluminum to the rivers, the effect on the rivers, and the role of the PWO system in protecting the rivers. The optimization team recommends continuing with these studies and using the resulting information when revisiting the remedial approach.

- ***Evaluate potential for residual sources.*** This recommendation is relevant if a source treatment approach is pursued and involves additional direct-push sampling with analysis for fluoride concentrations and leachability testing. The purpose of this recommended effort is to identify whether there are ongoing sources of fluoride contamination to groundwater that are extending the duration of the remedy and to better locate these sources.

- ***Improve source area delineation and monitoring.*** This recommendation is relevant if a source treatment or enhanced focused extraction approach is pursued. Direct-push sampling was conducted in 1997 to delineate the plume. Since that time, plume and source characterization and delineation has relied on sampling of monitoring wells that provide much lower resolution. In addition, many monitoring wells have been abandoned, further reducing the resolution of the sampling. This recommendation involves installing monitoring wells in select locations to improve monitoring of the source areas to better project remedy performance and duration.

- ***Evaluate source area remediation.*** This recommendation is relevant if source area remediation is pursued and involves evaluating the potential for source area remediation to cost-effectively reduce the remedy duration by evaluating source area fluoride stabilization through bench-scale testing. Stabilizing fluoride through mixing of appropriate amendments, could significantly reduce the need for groundwater extraction and accelerate the remedy.

- ***Evaluate the costs and benefits of enhanced FE.*** This recommendation is relevant if an enhanced FE approach is pursued. The current remedy is likely cost-effective because no treatment is required. However, the design of the remedy is a factor that limits the amount of groundwater extraction and mass removal that can occur from the FE system. A cost-benefit analysis would help determine if more aggressive FE could accelerate the remedy with a commensurate change in remedy cost.

- ***Revisit the well maintenance program to better control FE well fouling.*** Scale formation in the more contaminated FE wells is contributing to reduced well operation, decreasing extraction rates, and reducing overall source control and mass removal. Improvements to the well maintenance plan will help improve the performance of these wells and therefore improve the overall performance of the remedy.

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NOTICE AND DISCLAIMER

Work described herein, including preparation of this report, was performed by HydroGeoLogic, Inc. (HGL) for the U.S. Environmental Protection Agency (EPA) under Task Order 0066 of EPA contract EP-S7-05-05 with HGL. The report was approved for release as an EPA document, following the Agency's administrative and expert review process.

This optimization review is an independent study funded by EPA that evaluates existing data, discusses the conceptual site model (CSM), analyzes remedy performance, and provides suggestions for improving protectiveness, reducing cost, and making progress toward Site closure at the Reynolds Metals Company Superfund Site (RMC Site). Detailed consideration of EPA policy was not part of the scope of work for this review. This report does not impose legally binding requirements, confer legal rights, impose legal obligations, implement any statutory or regulatory provisions, or change or substitute for any statutory or regulatory provisions. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by EPA.

Recommendations are based on an independent evaluation of existing Site information, represent the technical views of the optimization review team, and are intended to help the Site team identify opportunities for improvements in the current remediation strategy and operation and maintenance (O&M) plan. These recommendations do not constitute requirements for future action; rather, they are provided for consideration by the EPA Region and other Site stakeholders.

While certain recommendations may provide specific details to consider during implementation, these are not meant to supersede other, more comprehensive planning documents such as work plans, sampling plans and Quality Assurance Project Plans (QAPPs), nor are they intended to override Applicable or Relevant and Appropriate Requirements (ARARs) established in the Record of Decision. Further analysis of recommendations, including review of EPA policy, may be needed before implementation.

PREFACE

This report was prepared as part of a national strategy to expand Superfund optimization practices from site assessment to site completion[1] implemented by the U.S. Environmental Protection Agency Office of Land and Emergency Management (OLEM), Office of Superfund Remediation and Technology Innovation [OSRTI]. The project contacts are as follows:

ORGANIZATION	CONTACT	CONTACT INFORMATION
EPA OLEM	Kirby Biggs	EPA OSRTI Technology Innovation and Field Services Division 2777 Crystal Drive Arlington, VA 22202 biggs.kirby@epa.gov Telephone: 703-823-3081
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[1] EPA, 2012. Memorandum: Transmittal of the National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion. From: James. E. Woolford, Director Office of Superfund Remediation and Technology Innovation. To: Superfund National Policy Managers (Regions 1 – 10). Office of Solid Waste and Emergency Response (OSWER) 9200.3-75. September 28.

LIST OF ACRONYMS AND ABBREVIATIONS

mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ARD	Assessment and Remediation Division
BART	Biological Activity Reaction Test
BLRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
EPA	U.S. Environmental Protection Agency
FE	focused extraction
FS	Feasibility Study
gpm	gallons per minute
HGL	HydroGeoLogic, Inc.
HQ	EPA Headquarters
IC	institutional control
K_{sp}	solubility constant
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge and Elimination System
NPL	National Priorities List
O&M	operation and maintenance
ODEQ	Oregon Department of Environmental Quality
OLEM	Office of Land and Emergency Management
ORD	Office of Research and Development
OSRTI	Office of Superfund Remediation and Technology Innovation
PRP	potentially responsible party
PWO	production well optimization
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RI	Remedial Investigation
RMC	Reynolds Metals Company
ROD	Record of Decision
RPM	Remedial Project Manager
SGA	Sand and Gravel Aquifer
SPLP	Synthetic Precipitation Leaching Procedure
USA	Unconsolidated Sedimentary Aquifer
USACE	U.S. Army Corps of Engineers

1.0 OBJECTIVES OF THE OPTIMIZATION REVIEW

For more than a decade, the Office of Land and Emergency Management (OLEM) over the Office of Superfund Remediation and Technology Innovation (OSRTI) has provided technical support to the U.S. Environmental Protection Agency (EPA) regional offices by using independent (third party) optimization reviews at Superfund sites. The Reynolds Metals Superfund Site (CERCLIS ID# ORD009412677) or Reynolds Metal Company Site (RMC Site) was nominated for an optimization review by the Region 10 (R10) Site Remedial Project Managers (RPMs) and Optimization Coordinators in January 2017. The focus of this optimization review is to evaluate the overall performance of the remedy, including the capture zones of the extraction system, potential modifications that could improve the remedy, and updated projections for achieving Record of Decision (ROD) Remedial Action Objectives (RAOs).

This optimization review used existing environmental data to interpret the conceptual site model (CSM), identify potential data gaps, and recommend improvements to the Site O&M. The optimization review team evaluated the quality of the existing data before using the data for these purposes. The evaluation for data quality included a brief review of data collection and management methods (where practical, the Site Quality Assurance Project Plan (QAPP) is considered), the consistency of the data with other Site data, and the potential use of the data in the optimization review. Data that were of suspect quality were either not used as part of the optimization review or were used with the quality concerns noted. Where appropriate, this report provides recommendations made to improve data quality.

2.0 OPTIMIZATION REVIEW TEAM

The optimization review team, which collaborated with representatives of EPA Headquarters (HQ) and EPA R10, consists of the independent, third-party participants listed in Table 1.

TABLE 1. Optimization Review Team

NAME	ORGANIZATION	TELEPHONE	EMAIL
Doug Sutton[1]	HydroGeoLogic, Inc.	732-233-1161	dsutton@hgl.com
Mindy Vanderford [1]	HydroGeoLogic, Inc.	713-838-7778	mvanderford@hgl.com

[1] *Attended the meeting on May 25, 2017.*

The following individuals contributed to the optimization review process, including attendance at the R10 review meeting or Site visit:

***TABLE 2. Other Optimization Review* Contributors**

NAME	ORGANIZATION	TITLE/ROLE
Piper Peterson	EPA Region 10	Remedial Project Manager
Bernie Zavala	EPA Region 10	Hydrogeologist
Kira Lynch	EPA ORD	Optimization Coordinator
Jenn Edwards	EPA ARD	HQ Regional Coordinator
Ted Repasky	EPA Region 10	Hydrogeologist

Notes:

ARD = EPA Assessment and Remediation Division (in the Office of Superfund Remediation and Technology Innovation)

ORD = Office of Research and Development

Documents reviewed for the optimization effort are listed in Appendix A (References).

3.0 SITE BACKGROUND

3.1 SITE DESCRIPTION

The RMC Site is located one mile north of the City of Troutdale, Oregon. The property is bordered by the Columbia River to the north, the Sandy River to the east, the Troutdale Airport to the south, and Salmon Creek to the west. RMC operated a primary aluminum reduction plant where aluminum was produced from the raw material alumina. Approximately 108 acres of the 800-acre site were occupied by the former plant area. The RMC Site operated under various owners and arrangements from 1941 to the fall of 2000 when the plant was permanently closed. The buildings were demolished in between 2003 and January 2006, and the property was sold to the Port of Portland in 2007. A U.S. Army Corps of Engineers (USACE) dike runs approximately east-west through the northern portion of the property, then turns south at the eastern property boundary. Site areas north and east of the dike are located within the 100-year floodplain. These areas are currently undeveloped and characterized by cottonwood-ash riparian forest and areas vegetated with blackberries and Scot's broom thickets (EPA, 2013)

According to the Five-Year Review (EPA, 2013), the RMC site was divided into four areas for the post-demolition investigation and evaluation of site soil conditions.

- Outside the USACE Dike – This area includes Company Lake, East Lake, and the western portion of the North Landfill.
- Fairview Farms – This area encompasses 227 acres and is west of Sundial Road. The area was not used for historical plant operations but may have received storm water overflow from the plant area via an adjacent ditch.
- South Wetlands – This area is 28 acres located south of the plant that was used as a settling pond for wastewater discharges during the early years of plant operation.
- East (Former Plant) Area – This area is 254 acres and includes the area where the former RMC plant was previously located. The Port of Portland has installed utilities and infrastructure to support future development in this area. The FedEx Ground facility was constructed and is in operation in a portion of this area known as Lot 11. The South Landfill, Scrap Yard, and East Potliner waste areas were located within the East Area.

These four areas and several potential source areas within the East (Former Plant) Area are depicted on Figure 1. The Site chronology is summarized in Table 3.

According to the second Five-Year Review (EPA, 2013), the Remedial Investigation and Feasibility Study (RI/FS) showed there were high levels of contamination in soil, waste, and debris and in North Landfill, South Landfill, the Scrap Yard, and East Potliner area. The North Landfill is located north of the USACE dike. The South Landfill, Scrap Yard, and East Potliner area are all located in the East (Former Plant) Area shown in Figure 1. High levels of contamination were also identified in the process residue that was located at the bottom of Company Lake. A fluoride plume is present in groundwater beneath the RMC facility. The contaminated materials in these waste areas were considered to be the primary sources of groundwater contamination.

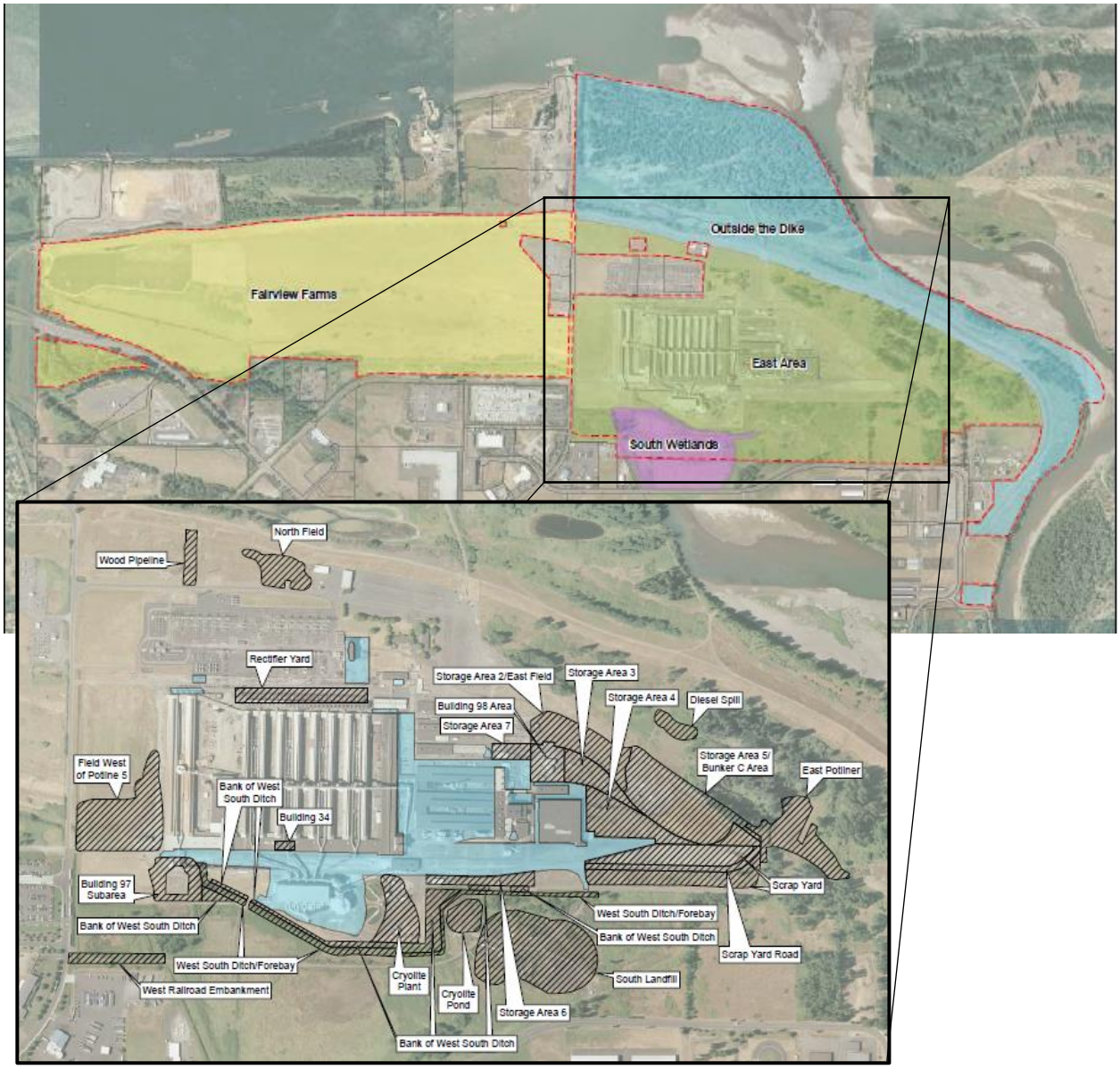

Figure 1: RMC site layout and potential former East Area source areas (EPA, 2006). All figures reproduced in Appendix B.]

TABLE 3. RMC Site Chronology

Date	Event
1941-1946	Aluminum Company of America operated the plant for the federal government.
1946-1949	RMC leased the plant from the government.
1949	RMC purchased the plant from the government.
1993	EPA conducted an investigation documenting contamination.
December 1994	The RMC Site was listed on the National Priorities List (NPL).
August 1995	The RI/FS Consent Order was signed.
1995-2002	Over 42,000 tons of waste, soil, and debris contaminated with fluoride, cyanide, polynuclear aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) was excavated and removed to permitted off-site disposal facilities as part of a Time Critical Removal Action.
June 2000	The RI/FS reports were submitted.
Fall 2000	RMC facility operations were suspended and then permanently shut down.
September 2002	The Interim ROD was signed.
2002-2005	93,854 tons of process residue and underlying sediment was excavated and removed from Company Lake and a barrier was installed to cover small quantities of residue that could not be removed due to slope stability concerns. 10,509 tons of waste and contaminated soil from the eastern portion of the North Landfill was removed for off-site disposal. A rock cap cover was installed on the western portion. 66,038 tons of waste and soil were removed for off-site disposal from the South Landfill.
July 2003	A unilateral order was issued for an Interim Remedial Action to address soil and waste areas.
2003 – Fall 2006	The plant buildings were demolished.
August 2005	A second unilateral order, for Remedial Design and Remedial Action of the groundwater system, was issued.
November 2005	Groundwater extraction began.
June 2006	The Post-Demolition Remedial Investigation report and Baseline Risk Assessment were submitted.
September 2006	The final ROD was signed.
2007	The Port of Portland purchased the former Reynolds property, and the Port of Portland agreed to act as the remedial action contractor for twelve years for operation and general maintenance of the FE/PWO system, including routine monitoring and reporting.
January 2008	A consent decree was filed with the court.
July 2008	The first Five-Year Review was signed.
2011	Institutional controls were completed for all properties at the Site.
September 25, 2013	The second Five-Year Review was signed.

3.2 REMEDIAL ACTION OBJECTIVES

The RAOs established in the final ROD (EPA, 2006) are as follows:

- Reduce human exposure through direct contact (ingestion, inhalation, and dermal contact) with contaminated soil and debris that would result in unacceptable excess lifetime cancer risk or above a Hazard Index of 1.0 for the reasonably anticipated (non-residential) future land uses. Consistent with Oregon Environmental Cleanup rules, an unacceptable excess lifetime cancer risk is 1×10^{-6} for one contaminants or 1×10^{-5} cumulative risk for multiple contaminants.

- Restore and maintain use of the groundwater (except the shallow silt unit) as a drinking water source. The restoration goal is the federal Maximum Contaminant Level (MCL) and state safe drinking water standard. Regarding the silt unit, the ROD states the following:

  > *Groundwater use restrictions are expected to be permanent for shallow contaminated groundwater (the silt unit) in the south plant area. The shallow silt zone is not considered a usable source of drinking water because of low yields in this portion of the aquifer. An evaluation of the restoration potential of the silt zone estimated that yields were generally below 0.1 gpm, which limits its potential use as a drinking water source. However, groundwater contaminated with fluoride at concentrations that exceed the drinking water standard have migrated from the silt unit into the underlying upper gray sand. Protection of the beneficial use of the underlying drinking water is anticipated through the combination of removal of the scrap yard soil source of contamination to groundwater, and operation of the FE wells in the upper gray sand beneath the silt unit (EPA, 2006).*

- Minimize the migration of contaminants from waste and soils to groundwater at concentrations that are protective for underlying drinking water, reduce the fluoride mass in shallow and intermediate groundwater, and control migration of fluoride and other constituents of concern in groundwater.

- Reduce and control the migration of fluoride in groundwater to the Sandy River.

The optimization team notes that the federal MCL for fluoride is 4 milligrams per liter (mg/L).

The extracted groundwater that is discharged to the Columbia River is governed by National Pollutant Discharge and Elimination System (NPDES) permit # 100757 issued by the Oregon Department of Environmental Quality (ODEQ. The NPDES standard for fluoride is 7.8 mg/L, which ODEQ considered to have no adverse effect on salmon passage based on discharged concentrations being diluted to below 0.5 mg/L within the mixing zone (ODEQ, 2007). The 2006 ROD further limits the fluoride discharge standard to 5 mg/L, which is lower (more protective) than the NPDES standard. The cyanide standards (for both the ROD and NPDES permit) are 0.025 mg/L for a monthly average and 0.05 mg/L for a daily maximum. Standards for PAHs and aluminum (which, according to the 2006 ROD, are not contaminants of concern [COCs]) were removed from the permit by ODEQ due to the low concentrations of these parameters in the discharge.

3.3 SELECTED REMEDY

The final ROD for the RMC Site was signed on September 27, 2006 and selected the following remedial actions:

- Institutional controls (IC) to ensure protection of future users of the Site and that future uses of the Site, including groundwater use, are compatible with the cleanup levels achieved. ICs are necessary to restrict residential use of the Site, restrict the use of groundwater that exceeds EPA MCLs as a drinking water source, and protect the integrity of the cap. The ICs include:
    - A legal description of the property with a corresponding map to identify the property where the ICs will be implemented.
    - A restrictive easement or covenant that runs with the land to prohibit residential use of the property, and identify conditions (i.e., additional protective measures, such as capping or special soil handling requirements) under which non-industrial site uses would be considered. For groundwater, the restrictions include a prohibition on use of Site groundwater that exceeds MCLs for drinking water, prohibition of other groundwater uses that would interfere with the successful operation of the groundwater focused extraction/production well optimization (FE/PWO) system, and access for inspection and continued operation of the system.
    - Use restrictions on the capped areas to protect the integrity of the existing cap or require suitable capping to allow for intended use of the area.
- Continued operation of the groundwater FE/PWO system (which began operation in November 2005) until groundwater cleanup levels are achieved or the EPA approves modification, reduction or suspension of the operation of the system. Groundwater from the FE/PWO system is discharged to the Columbia River pursuant to the NPDES permit and discharge standards described in Section 3.2. The two components of the FE/PWO system are as follows:
    - The FE component of the system involves extraction from two focused extraction wells (FE wells) in the upper gray sand near the Scrap Yard. Up to five FE wells have been used for this purpose since the remedy began. At the time of the optimization review, FE05 and FE06 were in operation. These wells were originally capable of maintaining extraction rates over 40 gallons per minute (gpm), but the extraction rates have decreased over time due to fouling and plugging of the wells or conveyance piping. Previous FE wells FE01, FE02, and FE03 also were impacted by fouling or scaling. The operational history of these well is graphically displayed in Figures 26 and 27 from the 2016 Annual Report (APEX, 2017), which are provided in Appendix B. The fluoride concentration on FE05 was decreased to under 10 mg/L. The fluoride concentration in FE06 remains above 40 mg/L. (See Figure 2 for FE well locations.)
    - The PWO component of the system involves extraction from up to four of the former production wells installed in the deep sand/gravel. The primary former production wells that have been used over the past several years are PW07 and PW08. The average pumping rate for each well is over 800 gpm. The PWO system typically extracts approximately 2.5 million gallons of water per day with a fluoride concentration of approximately 2 mg/L and a typical mass removal rate of over 30 pounds per day. The primary purpose of the PWO system is to capture contamination that was already in the intermediate sand or deep sand/gravel and dilute the fluoride contamination from the FE wells such that the blended water is under the NPDES discharge requirement of 5 mg/L. (See Figure 2 for PWO well locations.) By continuing to operate, the PWO wells continue to pull fluoride contamination into the intermediate sand and deep sand/gravel, perpetuating the use of the PWO system for addressing contamination in those deeper zones.

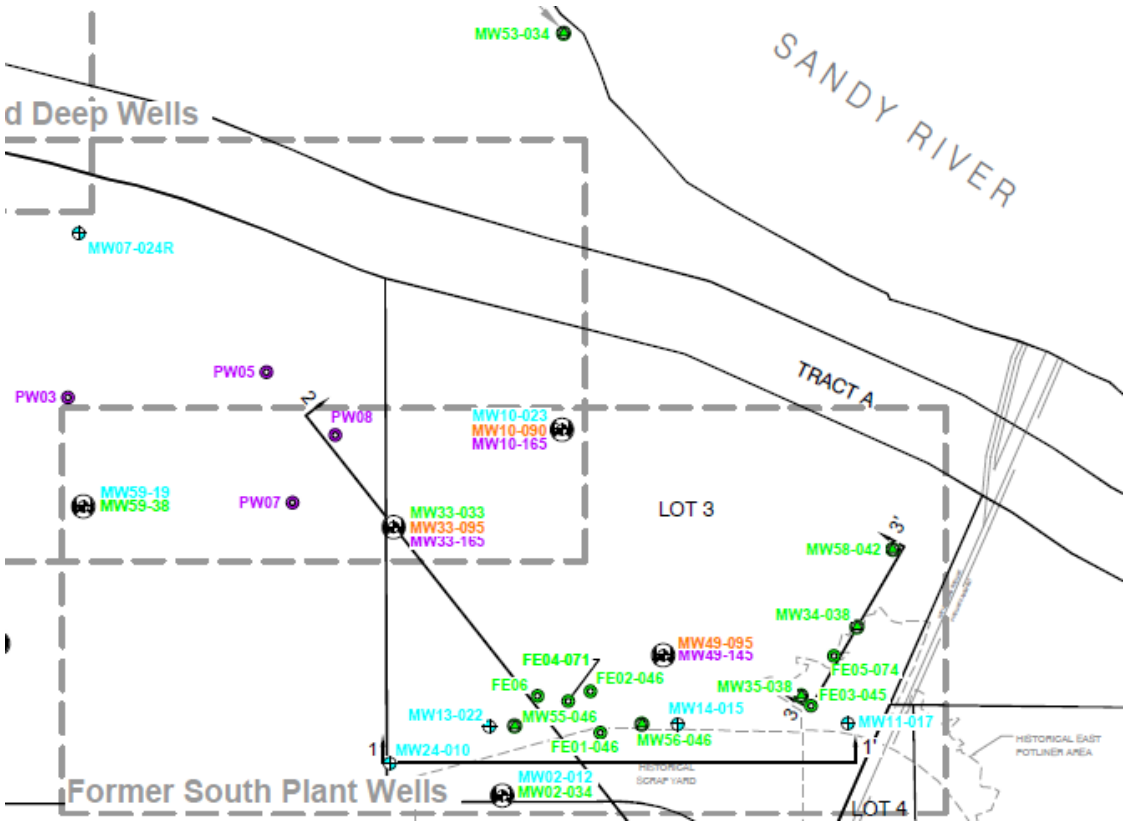

Figure 2: Locations of FE wells (FE02, FE03, FE04, FE05, FE06) and PWO wells (PW03, PW05, PW07, PW08). Refer to the outlines of the Historical Scrap Yard, Historical East Potliner Areas, and Sandy River to reference locations relative to historical features (APEX, 2017). All figures reproduced in Appendix B.

- Maintenance and monitoring of capped areas to ensure protection of human health and the environment, including inspections of the capped areas to verify cap integrity and making repairs when problems are observed. A cap inspection and maintenance plan will be required to be submitted to the EPA for approval and implementation and will be implemented in accordance with the approved plan.
- Monitoring groundwater to evaluate the effectiveness of the completed and ongoing cleanup actions.

The second Five-Year Review (EPA, 2013) states that the remedy was selected because the Post-Demolition Risk Assessment shows that current site conditions are within acceptable risk levels for direct contact for the reasonably expected future uses at the Site (i.e., industrial use). Previous cleanup actions (including a Time Critical Removal Action and soil, waste, and residue removal as an Interim Remedial Action) have achieved substantial and long-term risk reduction. Based on current information, EPA believes that known contaminated soil and debris have been removed from the Site so that residual concentrations of contaminants have been reduced to acceptable levels for future industrial use and that residual risks can be controlled by use of ICs. It is noted, however, that these assessments were based on

direct contact with contaminated soil and not necessarily the potential for contaminated soil to contaminate groundwater.

According to the final ROD (EPA, 2006), the ROD further concluded that the shallow silt unit in the South Plant area is not a usable source of drinking water because of low yields in this portion of the aquifer, and attainment of groundwater cleanup levels is not required for this area. The ROD further describes the end goals and estimated time frames for aquifer restoration:

> *The Groundwater FE/PWO will need to operate for an estimated 5 to 10 years to maintain hydraulic control and achieve protective levels in the intermediate and deep zones. Restrictions on the use of groundwater may need to continue for 20 years for some (generally shallower) portions of the aquifer, and are expected to be permanent for the shallow silt zone in the south plant area. (EPA, 2006)*

The ROD also states,

> *The groundwater remedy will complete the phased approach to groundwater restoration. The first phase of the groundwater remedy was source removal, which was completed through early removal actions and the remedial actions required by the Interim ROD to eliminate the sources of contamination to groundwater. The second phase was construction of the FE/PWO system, followed by successful start-up testing to demonstrate that the system is functioning as designed. The final phase is the operational phase, which requires operation of the FE/PWO system for approximately 5 to 10 years to contain the plume in the south plant area and restore groundwater quality. Control of migration of fluoride from the silt unit to the underlying drinking water is anticipated to be achieved through the combination of scrap yard soil source removal and continued operation of the focused extraction wells. (EPA, 2006)*

Based on the above statements, the ROD appears to suggest that the FE/PWO system would only need to operate for 5 to 10 years but that institutional controls may need to be in place for 20 years for some areas of shallow groundwater. It could also be interpreted, however, to suggest that the FE/PWO system would need to operate for 5 to 10 years to restore those zones plus many additional years to continue to protect those zones from contamination that would continue to migrate downward from the silt unit.

4.0 FINDINGS

4.1 WORKING CONCEPTUAL SITE MODEL

The optimization team's working CSM based on Site activities to date is presented below.

4.1.1 Contaminant of Concern and Primary and Secondary Sources of Contamination

The primary contaminant of concern for groundwater is fluoride, which is present at concentrations above the MCL of 4 mg/L due to waste and debris from aluminum production operations dating back to 1941. According to the ROD, sources of contamination to groundwater were generally associated with areas on Site where process-related waste and other discarded materials were stored or disposed of. The ROD summarizes several of the source areas and the interim actions taken at those sources. The following is a list of sources from the ROD that are associated with fluoride contamination:

- Removal actions between 1995 and 2002
    - Bakehouse Sumps Area: 283 tons of contaminated soil removed
    - Cryolite Ponds: 13,900 tons of cryolite removed
    - East Potliner Area: 11,542 tons of spent potliner and soils removed
    - ESP Containment Area: 1,193 tons of contaminated material removed
    - Fairview Farms: 150 tons of debris removed
    - Scrap Yard: 22,918 tons of waste and soil removed
    - West South Ditch: 8,775 tons of process residue, soil, and sediment removed
- Removal actions following 2002 Interim ROD
    - Company Lake: 93,584 tons of process residue and underlying sediment removed (some residue could not be removed)
    - North Landfill: 10,509 tons of waste and contaminated soil removed from eastern portion (western portion was capped)
    - South Landfill: 66,038 tons of waste and soil removed

These areas are depicted in the Figure 1. Based on the fluoride concentrations in shallow groundwater depicted in the ROD (see Figure 3), the following areas appear to have been substantial sources of fluoride contamination to groundwater:

- South Wetlands or West South Ditch
- South Landfill and possibly the Cryolite Ponds
- Scrap Yard
- East Potliner Area
- North Landfill
- Company Lake

Even though contaminated materials were removed from these areas, high levels of dissolved fluoride contamination persist more than 15 years after removal, potentially indicating residual sources of contamination. Fluoride confirmation sampling results following removal from three of these areas are reported below:

- Company Lake: <150 milligrams per kilogram (mg/kg) to 995 mg/kg of fluoride in soil confirmation samples

- Scrap Yard: <150 mg/kg to 1,690 mg/kg of fluoride in soil confirmation samples
- South Landfill: 170 mg/kg to 2,280 mg/kg in soil confirmation samples

Although the above concentrations may be protective with respect to human direct contact exposure pathways, the residual fluoride, if sufficiently leachable from soil, may be serving as an ongoing source of contamination via leaching to groundwater. The contamination within the silt unit is also serving as an ongoing secondary source of fluoride contamination to the underlying sands.

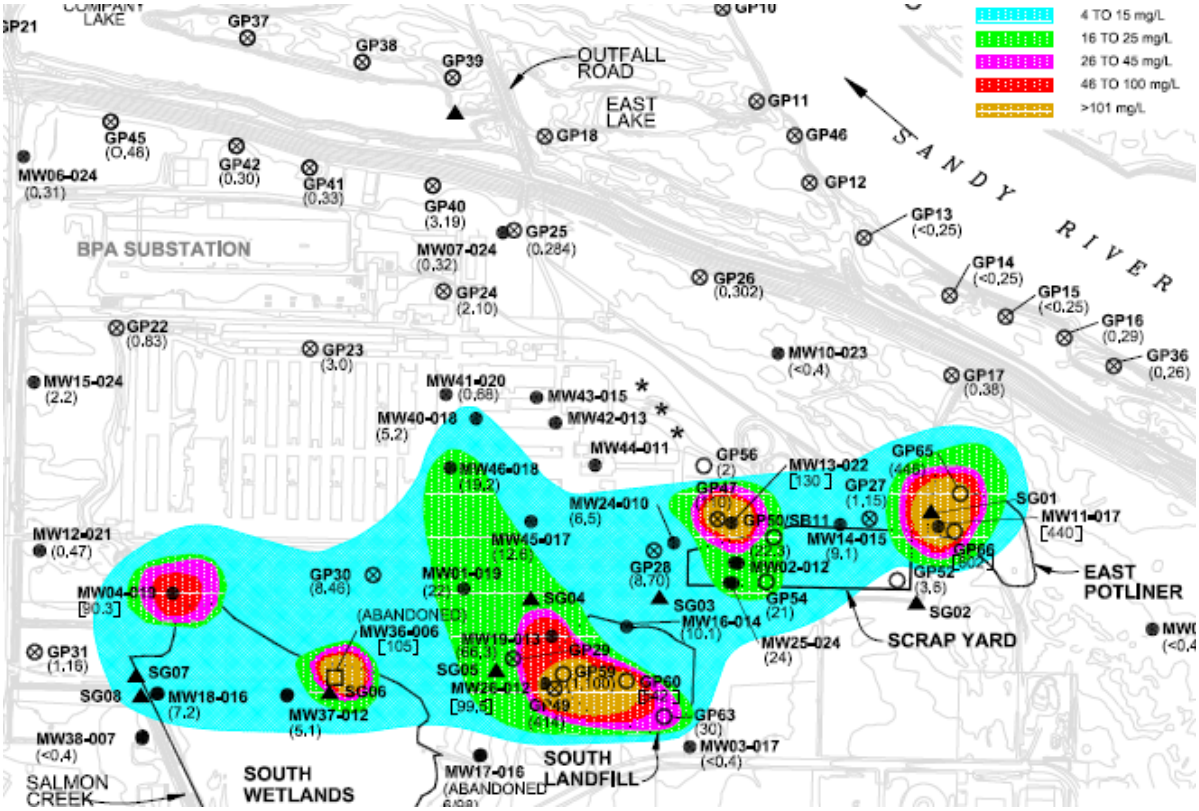

Figure 3: 1997/1998 fluoride concentrations in the silt unit, indicating historical sources of fluoride contamination. The color scale reflects the fluoride concentration (EPA, 2006). All figures reproduced in Appendix B.]

4.1.2 Geology and Hydrogeology

The ROD describes the hydrogeological conditions as follows:

> *Two regional aquifer systems exist under the Site. The Unconsolidated Sedimentary Aquifer (USA) is the uppermost aquifer, and the Sand and Gravel Aquifer (SGA) is the deeper unit. The unconsolidated sediments within the uppermost regional groundwater system beneath the facility have been subdivided into four water-bearing zones for purposes of investigation. The four zones are the silt unit (generally 0-30 feet deep), the upper gray sand (up to 50 feet deep), the intermediate sand (up to 100 feet deep), and the deep sand/gravel. The silt unit exists in the*

southern portion of the Site but does not generally occur in the northern portion of the Site. Groundwater generally discharges to the Columbia River in the northern portion of the Site and to the Sandy River in the eastern portion of the site.

Many of the municipal wells in the area, the facility production wells (now PWO system), and some of the deep sand/gravel monitoring wells at the Site are completed in to the SGA.

Groundwater flow through the silt unit, upper gray sand, and intermediate sand are highly variable due to significant changes in recharge and river stage. Groundwater elevation in the silt unit is generally significantly higher than in the underlying units and is likely controlled by its geometry, hydraulic conductivity, recharge, and discharge to the underlying upper gray sand. Groundwater flow in the silt unit is generally toward the northwest where the unit pinches out with groundwater discharging to the upper gray sand prior to reaching either of the rivers. Groundwater flow in the upper gray sand is more variable and appears to have a groundwater mound in the vicinity of Company Lake for the February potentiometric surface maps, suggesting infiltration to the upper gray sand in this area during the winter months. Small cones of depression resulting from FE well operation in the former process area are evident in most upper gray sand potentiometric surface maps. Potentiometric surface maps prior to pumping suggest that the upper gray sand, intermediate sand, and deep sand/gravel all discharge to the rivers.

Groundwater flow within the intermediate sand generally flows to the west. The February 2016 potentiometric surface map for the intermediate sand, which depicts a steep hydraulic gradient to the southwest, is misleading because the depth to water was plotted instead of the water elevation. Deep sand/gravel groundwater flow reflects the cone of depression from operation of the PWO wells.

Potentiometric surface maps from pre-FE pumping conditions and 2014 through 2016 for the silt, upper gray sand, intermediate sand, and deep sand/gravel are included in Appendix C.

4.1.3 Contaminant Fate and Transport

Plume Extent

The fluoride concentration maps in the ROD (from the 1997 to 1998 timeframe) provide an indication of contaminant fate and transport from the various sources prior to operation of the FE wells (the production wells were likely operating as part of facility operations). The maps are provided in Appendix B.

- Fluoride contamination in the silt unit is limited to source areas in the former process area and generally extend across the known extent of the silt unit to the northwest. (See Figure 3)

- Fluoride contamination in the upper gray sand is present beneath some of the former source areas, suggesting strong downward migration from the silt unit. As of the 1997/1998 timeframe, fluoride contamination from these source areas had migrated several hundred feet to the northwest in the upper gray sand, which suggests either relatively limited migration given that the source may be over 70 years old or that the contamination is migrating downward into the intermediate sand. There is also fluoride contamination in the general vicinity of Company Lake and the North Landfill. A gap in the contamination in the upper gray sand between the process area plumes and the Company Lake plume both before and after installation of the FE wells is noteworthy. The absence of fluoride contamination in this area of the upper gray sand suggests

that the majority of contamination in the upper gray sand migrates vertically into the intermediate sand due to the hydraulic influence of the production wells. (See Appendix B.)

- Fluoride contamination in the intermediate sand is evident near a source at the Scrap Yard and extends approximately 4,000 feet to the west, suggesting either significantly faster migration than that observed in the upper gray sand or contributions from Company Lake migrating vertically through the upper gray sand and into the intermediate sand. The fluoride concentrations in the intermediate sand near the Scrap Yard were as high as 98 mg/L, likely reflecting strong downward hydraulic head gradients due to deep pumping that caused vertical migration from the source near the surface, through the silt and upper gray sand and into the intermediate sand. (See Appendix B.) Elevated fluoride concentrations at MW33-165 (deep sand/gravel) also support migration of fluoride from the intermediate sand into the deep sand/gravel.

- In the deep sand/gravel, fluoride contamination above 4 mg/L is currently limited to MW33-165 and MW29-179. A deep sand/gravel plume map prior to remedy selection was developed but was not included in the ROD.

Fluoride does not degrade but it can precipitate out of solution under certain geochemical conditions, such as high calcium or high magnesium concentrations. In the absence of these conditions, fluoride attenuation will rely on dispersion and dilution.

Fluoride Trends

Fluoride trends in each of the subsurface units and key source areas are discussed below, providing an indication of remedial progress over time. Data tables and trend plots for individual monitoring locations are provided in Appendix D.

- Silt Unit (Note: The 4 mg/L cleanup standard does not apply to the silt unit and is used for reference only.):
    - South Wetlands: Fluoride concentration trends in the silt unit appear to be decreasing near one of the two South Wetlands sources. The source with the decreasing trend (near MW04-19) only has two data points since 1997. The two data points (42 mg/L in 2010 and 53.5 mg/L in 2015) are lower than the historical results (hence the description as a decreasing trend) but are insufficient to determine if the decrease is due to source removal activities or operation of the FE/PWO remedy. The data are also insufficient to establish a reliable or consistent trend. The sole monitoring well for the other (more easterly) source was abandoned; therefore, data are not available to determine a trend at that location.
    - South Landfill: At the South Landfill source (near MW26-12), there appears to be a decreasing concentration trend. Based on extrapolation of the fluoride trends on a semi-logarithmic plot, the optimization team estimates that the fluoride concentrations could potentially reach 4 mg/L by approximately 2036 (approximately 20 years from 2016) if the 2016 sample result is an outlier and the downward trend from 2010 through 2015 continues. It is also possible, however, that the 2016 sample is not an outlier and that concentrations may remain elevated for much longer than 20 years.
    - East Potliner Area: At the East Potliner source (near MW11-017), the fluoride concentration was over 100 mg/L as recently as 2015. Extrapolating the linear decreasing trend on the semi-logarithmic plot suggests to the optimization team that the fluoride concentration might reach 4 mg/L by approximately 2066 (approximately 50 years from

2016). Note that this time frame is substantially longer than the additional 9 years estimated in the 2016 Annual Report (APEX, 2017). The optimization team notes that extrapolating the time frame is subject to a reasonable degree of uncertainty and that the time frame could be shorter or longer. However, the estimate of 9 years is unrealistic in the optimization team's opinion as it would be based on sample results only from 2015 and 2016 and would ignore the more consistent trend over the past 20 years.

- Scrap Yard: The fluoride concentration at the Scrap Yard source (near MW13-022) is not decreasing and remains relatively stable at approximately 100 mg/L. Note that this is a different interpretation than described in the 2016 Annual Report (APEX, 2017), which states that 4 mg/L would be reached in 24 years.

The declining concentrations in the silt unit, where present, may suggest that the fluoride in the silt unit is migrating downward and serving as an ongoing source of contamination to the groundwater in the underlying upper gray sand. Areas with persistently elevated fluoride concentrations in the silt unit may also be an ongoing source of groundwater contamination for the upper gray sand. However, in these cases, the persistent fluoride concentrations may also suggest that there are soil sources serving as ongoing sources to the silt unit such that the silt unit concentrations are not declining despite the silt unit transferring fluoride mass to the upper gray sand.

The MCL of 4 mg/L does not apply to the silt unit, but it is a useful benchmark to help understand how long the fluoride in the silt unit may continue to impact the upper gray sand. The optimization team believes that the interpretation, averaging, and extrapolation used in the 2016 Annual Report are overly optimistic.

- Upper gray sand:
  - South Wetlands: Consistent with the 1997/1998 sampling, the upper gray sand does not show fluoride contamination in the vicinity of the South Wetlands. One possible exception is MW12-21, which shows an increasing fluoride concentration trend from under 1 mg/L to approximately 4 mg/L. MW12-21 is located downgradient of one of the source areas in the South Wetlands, and the increasing concentration may be due to migration from that source. The other upper gray sand current or former wells in this area (MW18-031, former MW38-035, and former MW37-030) appear to be located somewhat upgradient of the South Wetlands source areas and therefore may not be representative of potential upper gray sand impacts in this area.
  - South Landfill: The upper gray sand near the South Landfill is also poorly characterized by monitoring wells near the South Landfill source area. The one monitoring well in the area (MW26-50) has had a decreasing fluoride concentration trend and the fluoride concentration is now consistently below 1 mg/L. Higher concentrations may be present in the upper gray sand in the vicinity of silt unit well MW19-13 because this location is downgradient of the upper gray sand contamination historically observed at GP59. The concentration decreases at MW26-050 may be the result of the contamination being pulled to the east (rather than being depleted) due to operation of the FE/PWO system. ODEQ reports that the February and September 2017 concentrations were 13.9 mg/L and 7.3 mg/L, respectively, supporting the conceptual model that the recent decreased con concentrations reflect contaminant redistribution rather than contaminant removal.
  - East Potliner Area: The upper gray sand well near the East Potliner source with the highest fluoride concentration is MW34-038 with a concentration of approximately 100 mg/L. The concentration trend is increasing at this location, suggesting the potential for

an ongoing source of fluoride contamination to the upper gray sand groundwater in this area.

- Scrap Yard: The fluoride concentration trends near the Scrap Yard source are highly dependent on nearby FE well operation and the location of a monitoring well with respect to an operating FE well. It is difficult to determine if the relatively minor concentration decreases are due to changes in groundwater flow patterns due to well operation or if it is due to source depletion. Extrapolation of the decreasing trend at MW55-046 suggests that fluoride concentrations might reach 4 mg/L by approximately 2056 (approximately 40 years from 2016). However, the increasing trend at MW56-46 suggests a much longer time frame.
- Company Lake: With the exception of MW23-025, increasing with a 2017 concentration of approximately 30 mg/L, the fluoride concentration trends north of the Company Lake area are generally stable at approximately 10 mg/L. MW29-033, which is immediately south of the Company Lake area, has an increasing concentration trend. The fluoride concentration in this well has increased from below 1 mg/L to over 16 mg/L, possibly as the result of contamination from the Company Lake area migrating to the south or southwest. It is also possible that this is contamination that is migrating west or northwest from the Former Plant source areas. The groundwater flow directions are too irregular to determine a consistent groundwater flow direction; however, there appears to be a groundwater mound near Company Lake suggesting that the contamination north of Company Lake will discharge to the Columbia River.

- Intermediate Sand: The fluoride plume in the intermediate sand is poorly characterized over time, with only seven monitoring wells sampled in the vicinity of the plume defined in 1997/1998. One of these wells (MW30-100) helps delineate the plume to the northwest and has fluoride concentrations well below 1 mg/L. Another one of the wells (MW49-095) helps delineate the plume to the east near the source area and has fluoride concentrations routinely below 0.4 mg/L. Three of the wells within the plume (MW31-095R, MW29-090, and MW33-095) have decreasing concentrations, suggesting potential progress. A fourth well within the plume (MW27-081) has had a stable fluoride concentration of approximately 20 mg/L over the past 20 years, suggesting an ongoing contribution from the overlying upper gray sand. The sixth well (MW10-090) is located to the north of the 1997/1998 plume between the plume and the Sandy River. The concentration in this well has increased from below 1 mg/L to approximately 10 mg/L. This increasing fluoride concentration appears to be the result of eastward and downward migration of fluoride from the upper gray sand East Potliner plume. The other monitoring wells sampled in the intermediate sand are located far to the south of the 1997/1998 plume. Monitoring wells that would have been more effective at evaluating plume migration to the southwest, such as MW48-055, MW15-086, MW39-095, were abandoned between 2002 and 2005 during property redevelopment. These three wells, however, routinely had undetectable fluoride concentrations, and installation of new wells in these areas is not merited unless there are changes in local or regional groundwater extraction that could significantly alter groundwater flow directions. Other than MW33-095, which may be subject to changing groundwater flow directions due to changes in the river stage, there is no intermediate sand well near the Scrap Yard source that can monitor the fluoride concentrations that were originally detected at direct-push sampling locations GP-47 (41.2 mg/L), GP50 (31.4 mg/L), and GP56 (98 mg/L).

- Deep Sand/Gravel: Fluoride concentrations in deep sand/gravel monitoring wells are below 4 mg/L with two exceptions: MW33-165 and MW29-179. MW33-165, which is along a flow path from the Scrap Yard source area to the deep sand/gravel production wells, has a concentration of

approximately 40 mg/L or higher, and the trend appears stable or increasing. This stable or increasing concentration suggests ongoing source of contamination to this zone. The likely source is downward migration from the intermediate sand plume due to production well pumping in the deep sand/gravel. The downward migration from the intermediate sand to the deep sand/gravel appears to be occurring before the intermediate sand plume reaches MW33-095, potentially explaining why the fluoride concentration at MW33-095 is decreasing. The fluoride concentration at MW29-179 is approximately 10 mg/L and is slowly increasing. Downward migration from the intermediate sand due to production well pumping in the deep sand/gravel is likely the cause of this increasing trend between Company Lake and the PWO system.

4.1.4 Remedial System Performance

The 2016 Annual Report (APEX, 2017) reports that the FE wells have removed a total of 48,995 pounds of fluoride since 2005. The report further shows that the mass removal rate has not declined over time. However, Figure 29 from the 2016 Annual Report (APEX, 2017), which is included in Appendix B of this report, provides more detail. The mass removal rate for the PWO system has remained relatively constant while the mass removal rate for the FE system has been variable. The consistent mass removal rate from the PWO system suggests a large plume and ongoing sources of fluoride to the deep sand/gravel where the PWO wells are operating. The variability in the FE system mass removal likely results from localized decreases in concentrations and changes in extraction rates or extraction wells.

Referring to Figure 29 from the 2016 Annual Report (APEX, 2017), the cumulative mass removal from FE03/05 shows flattening of the curve at approximately 25,000 pounds, suggesting that the mass removal rate has decreased significantly. Review of Figure 26 of the 2016 Annual Report (APEX, 2017), also provided in Appendix B, shows that both the concentration and the flow rate have also decreased over time. The FE05 influent concentration is approximately 9 mg/L, which is relatively low compared to the 100 mg/L concentration in nearby well MW34-038, suggesting that FE05 is also extracting clean water because it may no longer be located within the core of the fluoride plume.

Referring to Figures 27 and 29 of the 2016 Annual Report (APEX, 2017), which are both provided in Appendix B, the mass removal rate from the FE06 location has been variable primarily due to the changes in the way FE wells are operating and the extraction rates at which they operate. For example, extraction from FE04 between 2007 and 2013 resulted in a consistent extraction rate of approximately 40 gpm, but the fluoride concentration was relatively low (generally below 10 mg/L). The FE system pumped approximately 90 gpm from 2008 through January 2015. Since 2015, extraction rates have been declining and currently average approximately 35 gpm. The extraction rate from FE06 between 2013 and 2016 has been variable due to complications with well operation, but the concentration has been much higher (typically between 40 and 60 mg/L). The mass removal rate at FE06 has generally dropped off with the extraction rate, suggesting there is more mass in this location to remove if the well can be operated consistently. In 2017, 85 percent of the fluoride mass removed by the FE wells was removed by FE06. Based on the historical findings at FE01, FE02, and FE03 and the recent performance issues with FE05, it appears the high fluoride water contributes to well and/or conveyance scaling or fouling issues in the FE area.

Based on the fluoride concentration trends presented earlier, a substantial amount of mass remains in the subsurface. While the remedy may be helping to limit discharge of fluoride to the Sandy River, progress to aquifer restoration is slow. Operation of the FE system appears to be removing a substantial amount of mass but not enough for timely restoration of the upper gray sand or intermediate sand. Furthermore, the FE systems appears unable to prevent downward migration of mass to the intermediate sand or to the

deep sand/gravel where it is removed by the PWO system (and primarily by PW-08, which is the production well with the shallowest screen interval). These limitations may be due to the nature of the remedy in which FE operation is constrained by the PWO operation to provide adequate dilution of the fluoride prior to discharge to the Columbia River. Without this constraint, mass removal and source control in the silt unit, upper gray sand, and intermediate sand could be accelerated, eventually cutting off the mass discharge to the deep sand/gravel and potentially eliminating the long-term need to operate the PWO system.

4.1.5 Potential Human and Ecological Exposure Pathways

Although the upper gray sand, the intermediate sand, and the deep sand/gravel are classified as drinking water aquifers, there is no current use of groundwater for drinking water in the immediate vicinity of the plume. However, ODEQ reports that the City of Portland Water Bureau has indicated that they have water rights on the Fairview Farms parcel, and the City of Troutdale has indicated they can exercise water rights on the former Reynolds site and expect the resource to be available as needed to meet future demand.

Future use of the Site is anticipated to be commercial/industrial, and the Baseline Risk Assessment (BLRA) (not reviewed) indicated that no excess risk to industrial workers (dermal contact exposure pathway) was presented by material remaining in soil after the remedial actions.

The remaining potentially complete current exposure pathways are for ecological and wildlife receptors. The Site encompasses surface water and wetlands potentially impacted by historical Site runoff and continuing discharge of affected groundwater. The BLRA found that hazard quotients were below ecological action levels for soils. The remaining priority potential ecological receptors are salmon, and potentially other aquatic vertebrates and benthic invertebrates in the Columbia and Sandy rivers. Therefore, in addition to focusing on aquifer restoration, the remedy focuses on reducing or preventing fluoride contamination in groundwater from discharging into the Sandy River in excess of protective concentrations.

4.2 SUMMARY OF DATA GAPS

4.2.1 Residual Sources

Although source removal activities have been conducted, the persistently high fluoride concentrations in some areas or the absence of a decreasing trend (such as the silt unit underlying the former Scrap Yard) suggest the potential for residual subsurface sources that are serving as ongoing sources of contamination to the silt unit, which in turn is an ongoing source of contamination for the underlying sands. Key areas with ongoing sources of fluoride to groundwater likely include the former Scrap Yard and East Potliner Area.

Although the ROD does not require the silt unit to meet a cleanup standard, the fluoride concentrations within the silt unit will need to decrease substantially if the underlying sands are to be protected in the absence of long-term remedy pumping. The fluoride levels within the silt unit that would be protective of the underlying sands is uncertain, and the magnitude of the continued flux of contamination into the silt unit from potential overlying sources is also uncertain.

Despite previous remedial efforts, Company Lake (near MW29-033) may also be serving as an ongoing source of fluoride contamination to groundwater.

4.2.2 Vertical Flux between Units

Water level measurements confirm a downward gradient through the various zones. Further, the increasing, stable, or relatively slowly decreasing concentration trends in some locations in the deeper zones suggest ongoing contributions of fluoride from the overlying zones, and potentially from the vadose zone.

4.2.3 Delineation of Fluoride Concentrations North of MW10-090

The increasing fluoride concentration trend at MW10-090 is between the historical extent of the plume and the Sandy River. There are no permanent monitoring wells north of this location in the intermediate sand, and the last samples that were collected were collected by direct-push sampling in 1997/1998.

4.2.4 Effect of Geochemistry on Fluoride Migration

Calcium fluoride (fluorite) is relatively insoluble with solubility product constants ranging from K_{sp} = 3.45×10^{-11} to 5.3×10^{-9} depending on the source. Magnesium fluoride is also relatively insoluble. As concentrations of calcium or magnesium are increased in water, calcium fluoride or magnesium fluoride should form and precipitate out of solution, effectively reducing the fluoride concentration in groundwater. The effects of increasing calcium and magnesium concentrations in groundwater on fluoride concentrations and fluoride migration is unknown.

4.2.5 Mass Flux of Fluoride to Surface Water that would Adversely Affect Potential Ecological Receptors

The remedy recognizes the need to reduce impacts of fluoride to Sandy River, but the mass flux of fluoride from groundwater to surface water is unknown as is the mass flux of fluoride that would adversely affect salmon or other potential ecological receptors has not been identified. A protective surface water fluoride concentration of 0.5 mg/L was used in development of the NPDES permit (ODEQ, 2007). The NPDES permit stated that 0.5 mg/L was found to cause no adverse effects on salmon passage. The protectiveness of the 0.5 mg/L goal on benthic invertebrates is unknown.

5.0 RECOMMENDATIONS

Site-specific recommendations are provided for the five major areas associated with optimization: remedy effectiveness, cost reduction, technical improvement, progress toward site closure, and environmental footprint reduction. Table 4 provides a summary of the recommendations and estimated costs/ savings for implementing each recommendation. The levels of certainty for the cost estimates provided are comparable to those typically prepared for CERCLA FS reports (-30 to +50 percent) and are considered rough estimates for planning purposes.

5.1 CLARIFY THE REMEDIAL APPROACH

The Final ROD could be interpreted in multiple ways with regard to the estimated time frame for FE/PWO system operation. The ROD text could be interpreted to mean i) that the system will need to operate for 5 to 10 years total to achieve the RAOs for the upper gray sand, intermediate sands, or deep sand/gravel or ii) that the system will need to operate for 5 to 10 years to restore these zones but will need to continue operating for many additional years into the future to prevent recontamination of these zones from continuing sources like the silt unit. The remedy progress to date and the current concentration trends demonstrate that the FE/PWO system will need to operate for significantly longer than 10 years due to both ongoing sources and incomplete control of those sources. Therefore, the expected time frame for meeting RAOs in groundwater is not being achieved. The paths forward for three different remedial scenarios are presented below:

- If the intent of the remedy in the ROD is to provide for timely restoration of the sand and sand/gravel zones and a short-term, finite duration of FE/PWO system operation, then additional characterization and remediation of sources are necessary. More specifically, the contamination that was left in place near the South Wetlands, South Landfill, Scrap Yard, East Potliner Area, the silt unit, and Company Lake would need to be further characterized and remediated. Recent or imminent industrial development of these areas could significantly complicate such source characterization and remediation. For example, the optimization team understands that a new, development is currently being constructed over the South Landfill, making any residual sources in the vicinity of the South Landfill potentially inaccessible.

- If the intent of remedy in the ROD is to provide for timely restoration of the sand and sand/gravel zones but long-term groundwater extraction to maintain the restored conditions, then source remediation would not necessarily be needed but modifications to the current groundwater extraction system would be needed. For example, enhanced FE would be needed in the vicinity of the silt unit to prevent contamination from migrating horizontally in the upper gray sand or vertically into the intermediate sand and deep sand/gravel. Groundwater extraction near Company Lake would also likely be necessary. Due to the expected fluoride loading from the extracted groundwater, the extracted water would likely need to be treated prior to discharge rather than diluted with water from the PWO system. This type of effort would need to be coordinated with planned or imminent industrial development.

- Currently, the remedy is not restoring the upper gray sand, intermediate sand, or deep sand/gravel in a timely manner and is not meeting the intent of the ROD, but it is likely containing the majority of the fluoride plume on the former Reynolds property and is reducing the flux of fluoride to the adjacent rivers. The current FE/PWO remedy, which avoids treatment of the fluoride-impacted water prior to discharge, is cost-effective, but the extraction network will not allow for restoration of the impacted portions of the upper gray sand, intermediate sands, or deep sand/gravel, which may be needed by local municipalities for future water supply. In addition, further evaluation would be needed along the river banks to confirm the flux of fluoride to the rivers is protective of potential receptors.

The costs and likelihood of success for the first two options are too uncertain to quantify at this time because the extent of the source remediation or FE is not known. However, it is reasonable to expect that either of these two approaches would cost significantly more than the current approach of diluting the water prior to discharge. It is also reasonable to expect that complete source removal may not be accomplished given the limited access resulting from the recent property development. Finally, it is recognized that the PWO system, in its current form, despite enhancing vertical migration of contamination in the intermediate sands and deep sand/gravel, is likely reducing overall flux of fluoride contamination to the rivers. Therefore, before modifying the PWO system, the flux of contamination to the rivers (with and without PWO system operation) and the resulting impacts on the receptors within these rivers should be better understood. Some form of deep pumping might be needed for the remedy to be protective, but continuing with the current FE/PWO system is not meeting the intent of the ROD.

With the above scenarios and considerations in mind, the optimization team provides a series of recommendations that would be involved with the various options.

The first recommendation (Section 5.2) involves revisiting the risk to the receptors within the two rivers and the role of the PWO operation in protecting these receptors because these receptors need to be protected regardless of the path forward.

The other recommendations pertain to one or more of the above scenarios.

- Recommendations 5.3, 5.4, and 5.6 pertain directly to the first scenario, which would involve source area remediation.
- Recommendations 5.4, 5.5 and 5.7 pertain directly to the second scenario, which would involve enhanced FE.
- Recommendations 5.5 and 5.7 pertain directly to the third scenario, which could potentially involve little or no change in the current remedy configuration.

5.2 REVISIT POTENTIAL ECOLOGICAL RISK DUE TO FLUORIDE CONTAMINATION OF SURFACE WATER AND THE ROLE OF THE PWO SYSTEM

The actual flux of fluoride to the Columbia River and the Sandy River is unknown, but the optimization team understands that several studies are underway to more fully evaluate this flux, the resulting surface water concentrations, and the potential impact on receptors in the rivers during different seasons. Modeling can also be used to estimate flux to the rivers in the absence of PWO pumping. The

optimization team recommends continuing with these studies and revisiting the published data on fluoride toxicity for salmon and other potential receptors in the Columbia River and Sandy River water.

Based on review of published toxicity data and the findings from the above-mentioned field and modeling studies, the Site team should be able to develop a groundwater concentration that would be protective of surface water receptors, including salmonids. The derived concentration should consider other water quality parameters that may affect fluoride toxicity, such as hardness, pH, and temperature and other constituents of concern, such as aluminum. The derivation should also consider discharge of fluoride from groundwater to the Sandy River and discharge of fluoride from groundwater and the NPDES outfall to the Columbia River. By way of comparison, the ecological screening value for fluoride in surface water established by Canadian Guidelines is 0.120 mg/L (CCME, 2003). The screening value used in derivation of the NPDES permit was 0.5 mg/L.

Based on the findings of the above evaluation, the cleanup standard, NPDES permit discharge standards, and PWO system may need to be adjusted. It may be determined that PWO system operation or other deep pumping is either critical or not necessary for protection of the wildlife receptors in the rivers. If deep pumping is critical for protection, the extraction rates or well configurations may need to be modified. The need for PWO system (or other deep groundwater extraction) and the associated extraction rates will help inform the role of deep pumping for the various paths forward. Under a source removal approach, deep pumping may need to continue for a period of time to be protective. Under an enhanced FE approach, the influence of deep pumping will affect FE system extraction well locations and rates, requiring more aggressive FE extraction to overcome the hydraulic influence of the deep pumping and allow cleanup of deeper units. The quantity and quality of deep water that is extracted will also be a factor in how the FE water will be handled.

Regardless of the approach, groundwater monitoring wells will need to be installed adjacent to the rivers in locations where groundwater discharges to surface water, such as near 1997 direct-push locations GP11 and GP04. These wells would constitute point of compliance locations where groundwater concentrations cannot exceed levels protective of wildlife receptors given the dilution provided by each surface water body.

It is unclear if sediment exposures were considered in the BLRA. If sediment hazard quotients have not been calculated for benthic receptors, then the groundwater discharging to sediment pathway should also be reviewed for protectiveness. By way of comparison, the screening level for fluoride in sediment promulgated by the Dutch National Institute for Public Health and the Environment is 500 mg/kg.

The cost of implementing this recommendation might be approximately $50,000.

5.3 EVALUATE POTENTIAL FOR RESIDUAL SOURCES

This recommendation is relevant if potential source characterization and removal is planned.

The persistently elevated fluoride concentrations in the silt unit groundwater suggests that ongoing sources of fluoride may be impacting the silt unit, which, coupled with contaminant mass flux from the silt unit to the upper gray sand, is slowing progress toward restoration of the upper gray sand and the underlying zones. Additional investigation and characterization would help determine if residual sources are present and where they are located.

Continuous soil cores conducted from the surface to the bottom of the silt unit would be recommended. Soil samples from the soil cores would be collected at multiple depths to evaluate the fluoride concentrations in the soil profile. Leachability testing should also be conducted to determine the mobility of the fluoride that is detected in the soil. The results should help determine if fluoride-containing waste is present, or if high concentrations of fluoride adsorbed to soil could leach from soil over time. Up to five continuous coring sampling locations are suggested in the vicinity of each of the following locations, which would total up to 40 coring locations:

- MW04-019
- Former MW36-006
- MW13-022
- MW11-017
- MW19-013
- MW26-012
- MW27-045
- Former GP60

Up to 10 soil samples would be taken from each of the locations and analyzed for fluoride. The three samples from each coring location with the highest results should be submitted for leachability testing using the Synthetic Precipitation Leaching Procedure (SPLP) or another laboratory procedure that may be more applicable to evaluating leachability of fluoride at this Site.

The optimization team recognizes that previous characterization of these areas was done when the soils from these areas were excavated, but those historical efforts did not appear to be focused on identifying ongoing sources of fluoride contamination to groundwater. For example, the removal and confirmation samples for the Scrap Yard were at most 2 feet deep. Elevated fluoride concentrations were identified in the confirmation samples, and there is additional soil between the confirmation samples and the silt that could be serving as an ongoing source to the silt due to infiltration of water or rising and falling water levels.

The optimization team also recognizes that the above-ground industrial development could complicate these efforts and that such complications should be considered prior to electing to proceed with a remedial strategy that involves source area remediation. For example, even though the Scrap Yard and East Potliner Area are likely still accessible given the current stage of development, the South Landfill and South Wetlands areas are likely no longer accessible, making it difficult for source area remediation to be successful on its own.

The optimization team estimates that this recommendation may cost approximately $250,000 to plan, implement, and document if the Site team decides to move forward with a source area remediation approach and complications with the above-ground industrial development have already been addressed.

5.4 IMPROVE SOURCE AREA DELINEATION AND MONITORING

This recommendation is relevant if potential source characterization and remediation is planned or if enhanced FE is planned.

Some areas of the upper gray sand near the sources are poorly characterized for the purpose of delineating the source area and monitoring source area restoration. In the South Wetlands, the only remaining monitoring well (MW18-031) is not suitably located with respect to the impacts that are detected in the overlying silt unit. As a result, the apparent absence of a plume in this area of the upper gray sand may be

an artifact of the monitoring network. New monitoring wells should be installed as follows, if the locations are accessible:

- A minimum of one additional monitoring well in the upper sand in a location that is immediately beneath or immediately downgradient of each of the two South Wetlands source areas.
- One monitoring well in the upper gray sand downgradient of the South Landfill source area near MW19-013.
- One monitoring well in the intermediate sand immediately downgradient of former direct-push point GP50 in the Scrap Yard to better monitor source area concentrations.
- One monitoring well in the intermediate sand northeast of MW10-090 to delineate the fluoride plume between MW10-090 and the Sandy River.

The optimization team estimates that installing and sampling three new upper gray sand monitoring wells and one intermediate sand well will cost approximately $120,000 to plan, implement, and document. Site stakeholders would need to review current and future development plans and locate the wells accordingly.

5.5 EVALUATE SOURCE AREA REMEDIATION

This recommendation is also relevant if potential source characterization and removal is planned.

The recommendation in Section 5.2 would provide information regarding the potential for an ongoing source of fluoride contamination to groundwater. If sources are identified, source remediation could reduce remedy cost and remedy duration relative to enhanced focused extraction if sources can be sufficiently remediated to eliminate the need for long-term groundwater extraction. One potential option for source remediation could be in situ treatment with calcium hydroxide and calcium chloride addition. Addition of these chemicals would facilitate the formation of calcium fluoride, which would immobilize much of the fluoride that is currently adsorbed to soil and would remove dissolved fluoride from groundwater through precipitation.

Assuming the characterization effort recommended in Section 5.2 identifies soil with high fluoride concentrations that can leach into groundwater, the optimization team recommends using some of the collected soils and groundwater for bench-scale treatability testing. The treatability testing should evaluate various doses of the calcium hydroxide and calcium chloride at various pH values to determine the chemical combinations and doses that would be necessary to significantly reduce fluoride mobility and remove fluoride from groundwater. The study should also consider the potential for the re-dissolution of fluoride under natural conditions. Treated soils should be tested for fluoride leachability, and treated groundwater should be tested for reductions in fluoride concentrations. The resulting information may also provide insight into how natural levels of calcium may be affecting fluoride migration.

If the bench-scale testing is successful, then pilot testing should be considered. Application of the chemicals could be done through in situ mixing for the silt unit or injection for the upper gray sand.

The optimization team estimates that the treatability study might cost $100,000, including documentation. The costs for pilot testing would be dependent on scale of the pilot test and the outcome of the treatability studies.

The optimization team recognizes that that some of the source material may be inaccessible due to recent industrial development. The optimization team cautions against source remediation if the remediation does not eliminate the need for source control with groundwater extraction. Therefore, source characterization data should be carefully considered and weighed against the need for continued groundwater extraction before continuing with a source remediation approach.

5.6 DEVELOP OPTIONS FOR ENHANCED FOCUSED EXTRACTION TO CONTROL RESIDUAL SOURCES

This recommendation is relevant if enhanced FE is pursued.

The current remedy allows contamination from the upper gray sand to migrate downward into the intermediate sand and then to migrate further downward to the deep sand/gravel prior to being extracted by the PWO system. This approach, in which the majority of contaminant mass is extracted from the deep sand/gravel, results in dilute fluoride concentrations in extracted groundwater that meet the discharge requirements.

Enhancing the FE system to provide control of the remaining sources is not straightforward because the sources would need to be better understood, the FE system would need to be expanded accordingly, the influence of the PWO system (if it needs to continue to operate) would need to be known, and a means of handling the increased FE flow rate and fluoride loading would be needed. Dilution with the PWO system would likely be inadequate, and if PWO extraction were to be increased, it would likely require further increases in the FE to overcome the influence of the PWO system and provide the needed source control. The optimization team would recommend the following approach to enhancing the FE system.

- Implement the recommendations in Sections 5.2 and 5.4 above to provide additional information regarding the PWO system and the source areas. Use the resulting information and other existing information to establish a target capture zone.
- Provide the existing groundwater flow model to the EPA for review. Upon concurrence on model construction and calibration from EPA, use the model to determine the well locations, depths, and extraction rates needed to control the various fluoride sources. Conduct this analysis with the appropriate PWO system operational parameters. gray
- Estimate influent concentrations of fluoride from the FE system.
- If the PWO system is going to continue to operate, determine if the extracted FE water can be sufficiently diluted prior to discharge using the PWO system water. If PWO system is not going to operate or if the PWO system will not sufficiently dilute the FE water, evaluate various treatment options. One potential treatment approach that could be considered is addition of calcium hydroxide and calcium chloride combined with filtration to precipitate and remove fluoride.
- Evaluate changes in the monitoring program that would result from altering the groundwater FE program.
- Document various viable options in a report for review.

In addition to FE options within the upper gray sand, consider the use of a horizontal well in the silt unit. Extraction from the silt unit was considered during the FFS (CH2M Hill, 1999); however, only vertical wells were considered. The use of a horizontal well may be more cost-effective than a large number of vertical wells and should help work around the planned or future industrial development. It may also be

more cost-effective to handle a low volume of highly contaminated water than a higher volume of water with more dilute contamination from the upper gray sand.

The optimization team understands that various treatment options for extracted water were considered during the FFS; however, dilution with the PWO was a viable option at the time and may no longer be a viable option. In addition, new options for extraction (including horizontal wells) are now available and more robust than at the time of the FFS.

The optimization team expects that this evaluation might cost $100,000 due to the modeling work and cost estimating that is needed. Use of an existing groundwater model that is acceptable to EPA is assumed.

5.7 REVISIT THE WELL MAINTENANCE PROGRAM TO BETTER CONTROL FE WELL FOULING

The fouling or scaling of the FE wells and piping has contributed to reduced operation time, reduced source control, and reduced mass removal. To date, FE system fouling or scaling resulted in the replacement of multiple FE wells. The optimization team recommends analyzing the form of fouling to determine the fundamental cause. A sample of the scale can be analyzed to evaluate the nature and composition of the scale. Given the correlation of the scaling within high fluoride concentrations, calcium fluoride formation or aluminum may be a key component of the scaling. Biological testing using the Biological Activity Reaction Test (BART) could help determine if there is a biological component to the fouling. Based on the results, the well and piping maintenance program, which currently involves use of a weak acid cleanser, can be revisited or updated. For example, routine or continual use of dispersants or chelating agents may be more effective than acid cleansers at maintaining extraction well and piping performance. The specific capacity of the FE wells should also be measured monthly to evaluate a reduction in well performance. Often, the well fouling or scaling problem is advanced by the time there is a noticeable reduction in the extraction rate. The optimization team estimates that this evaluation should cost approximately $20,000 to test and evaluate options. Measuring and evaluating the specific capacity should be straightforward to incorporate into the existing O&M plan.

TABLE 4. Recommendations and Cost Summary

RECOMMENDATION	EFFECTIVENESS	COST REDUCTION	TECHNICAL IMPROVEMENT	SITE CLOSURE	ENVIRONMENTAL FOOTPRINT REDUCTION	ESTIMATED CAPITAL COST	CHANGE IN ANNUAL COST
5.1 Evaluate potential for residual sources	X			X		$250,000	
5.2 Improve source area delineation and monitoring	X			X		$120,000	
5.3 Evaluate the costs and benefits of enhanced focused extraction	X			X	X	$100,000	
5.4 Revisit potential ecological risk due to fluoride contamination of surface water	X			X		$50,000	
5.5 Evaluate source area remediation	X			X	X	$100,000	
5.6 Initiate a well maintenance plan	X		X			$20,000	

"X" Indicates that the recommendation pertains to the indicated optimization category

APPENDIX A:

REFERENCES

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EPA, 2013. *Second Five-Year Review Report for Reynolds Metals Superfund Site, City of Troutdale, Multnomah County, Oregon*. September, 25.

APPENDIX B:

SUPPORTING FIGURES

Figure 1 - Vicinity Map

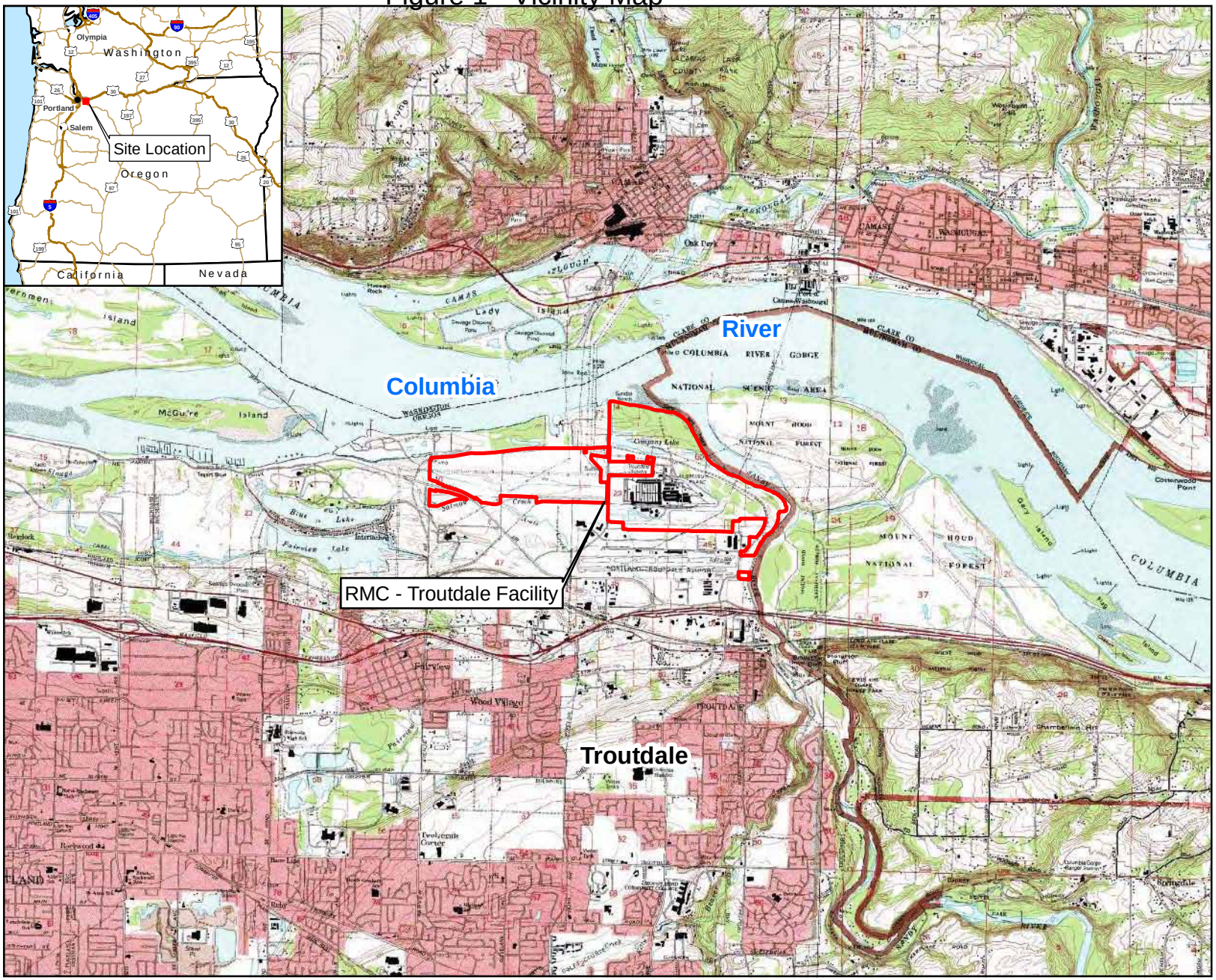


Figure 2 - Site Features and Evaluation Area

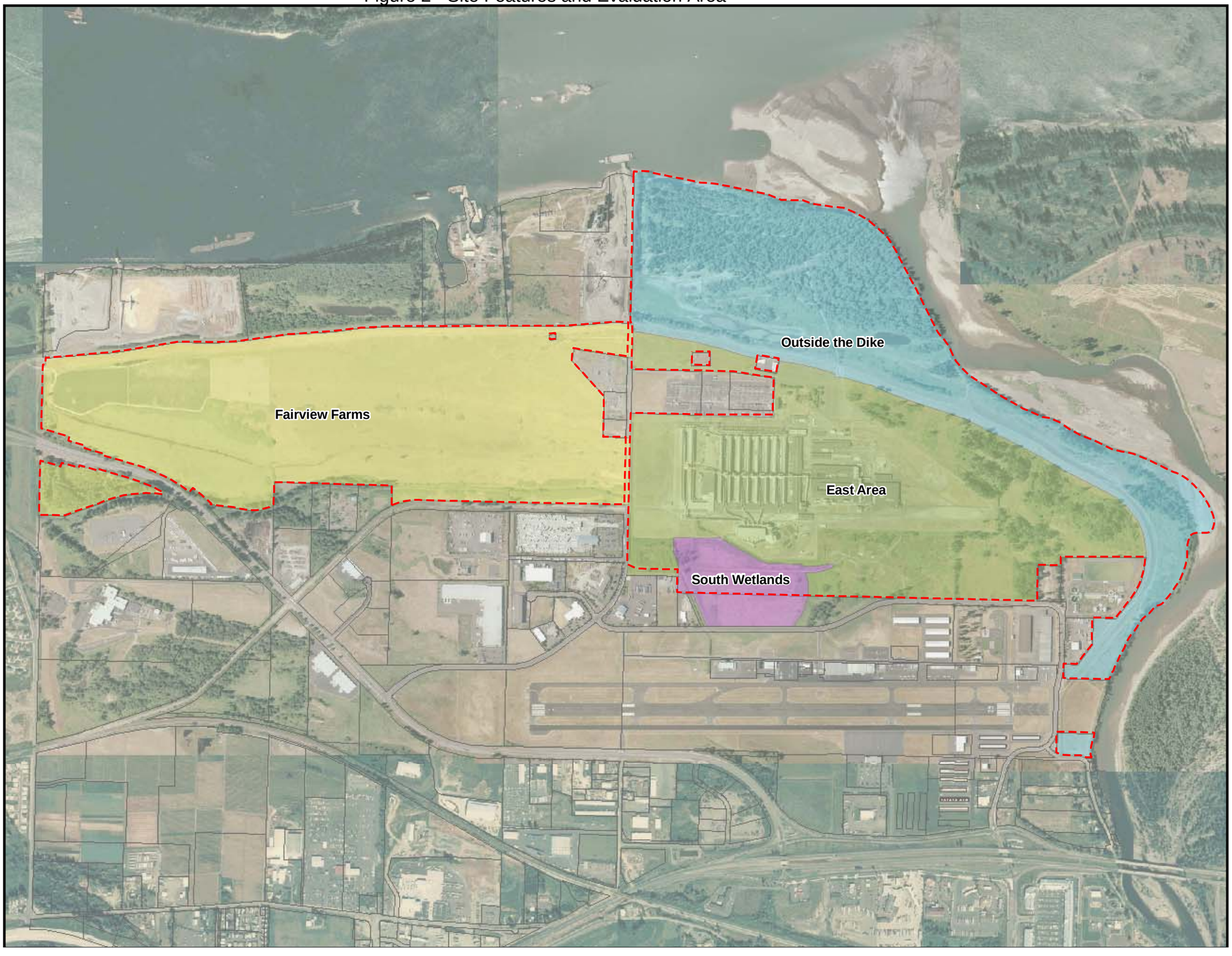


Figure 3 - RMC Site East Area - Detail View

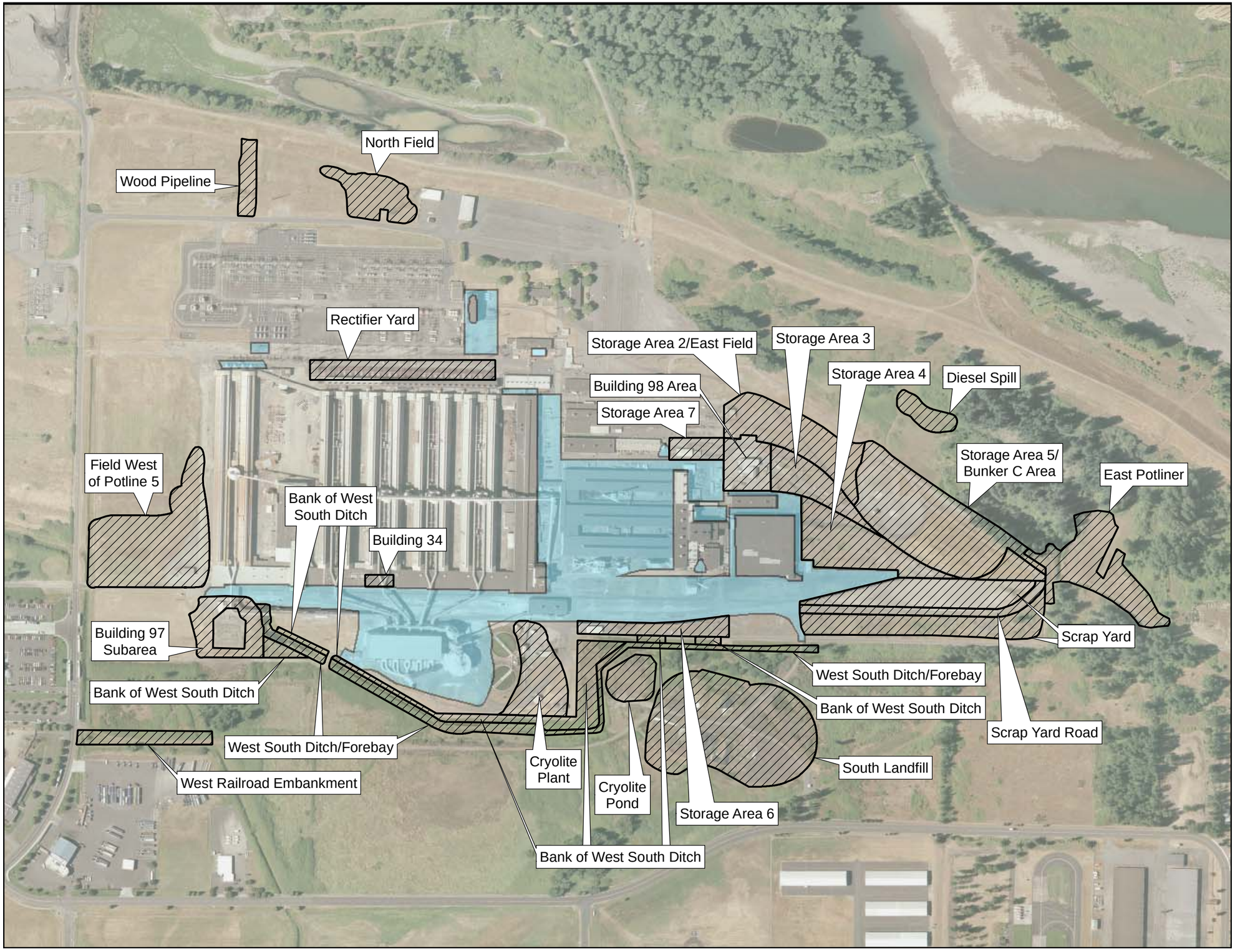


Figure 4 Shallow Silt Zone Fluoride Plume

NOTE:

MONITORING WELLS NORTH OF COMPANY LAKE PRIMARILY SCREEN GRAY SAND. LITTLE SILT IS OBSERVED IN THE SHALLOW SUBSURFACE NORTH OF THE COE FLOOD CONTROL DIKE.

FLUORIDE VALUE (mg/L) IS FROM FIELD MEASUREMENT. IF LABORATORY FLUORIDE CONFIRMATION IS HIGHER, THAT VALUE IS POSTED AS INDICATED BY [ ].

FLUORIDE VALUES ARE GIVEN FOR GEOPROBE BORINGS DRILLED IN THE SILT. OTHER GEOPROBE LOCATIONS ARE SHOWN ONLY TO INDICATE THEIR ARRANGEMENT ACROSS THE SITE.

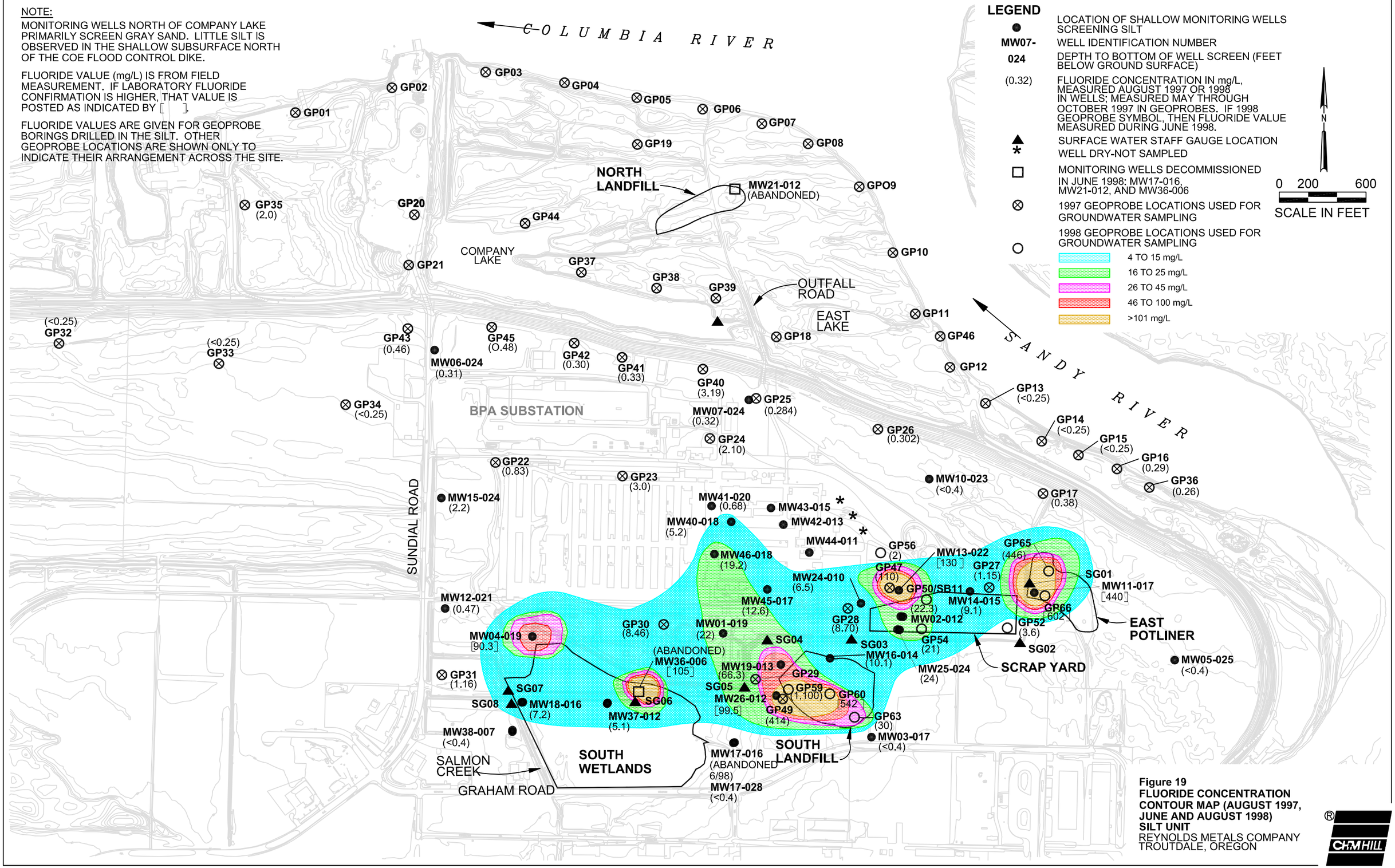


Figure 19
FLUORIDE CONCENTRATION CONTOUR MAP (AUGUST 1997, JUNE AND AUGUST 1998) SILT UNIT
REYNOLDS METALS COMPANY
TROUTDALE, OREGON

CH2M HILL

PLOT DATE: 23-May-2006 FILENAME: \\Rosa\proj\REYNOLDS\39293\CD\COLOR6D-Fig 19.dwg

Fig. 5 - Upper Grey Sands Fluoride Plume -UGS

NOTE:
FLUORIDE VALUE (mg/L) IS FROM FIELD MEASUREMENT. IF LABORATORY FLUORIDE CONFIRMATION IS HIGHER, THAT VALUE IS POSTED AS INDICATED BY [ ].

FLUORIDE VALUES ARE GIVEN FOR GEOPROBE BORINGS DRILLED IN THE UPPER GRAY SAND. OTHER GEOPROBE LOCATIONS ARE SHOWN ONLY TO INDICATE THEIR ARRANGEMENT ACROSS THE SITE.

LEGEND

- ● LOCATION OF SHALLOW MONITORING WELLS SCREENING UPPER GRAY SAND
- **MW08-** WELL IDENTIFICATION NUMBER
- **027** DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
- (2.8) FLUORIDE CONCENTRATION IN mg/L, MEASURED AUGUST 1997 OR 1998 IN WELLS; MEASURED MAY - OCTOBER 1997 IN GEOPROBES; FOR 1998 GEOPROBE LOCATIONS FLUORIDE MEASURED DURING JUNE 1998.
- ⊗ 1997 GEOPROBE LOCATIONS USED FOR GROUNDWATER SAMPLING
- ○ 1998 GEOPROBE LOCATIONS USED FOR GROUNDWATER SAMPLING
- 4 TO 15 mg/L
- 16 TO 25 mg/L
- 26 TO 45 mg/L
- 46 TO 100 mg/L
- >101 mg/L

N

0 200 600
SCALE IN FEET

COLUMBIA RIVER
SANDY RIVER
SUNDIAL ROAD
GRAHAM ROAD
NORTH LANDFILL
COMPANY LAKE
OUTFALL ROAD
EAST LAKE
DIKE
BPA SUBSTATION
SOUTH WETLANDS
SOUTH LANDFILL
EAST POTLINER
SCRAPYARD

GP02 (3.09)
GP01 (1.24)
MW52-045 (10.3)
GP03 (12.0)
MW08-027 (2.8)
GP04 (13.0)
GP05 (0.77)
GP06 (0.48)
GP07 (0.64)
GP08 (0.29)
GP19 (4.60)
MW30-030 (0.85)
MW27-045 (20.2)
MW09-030 (31.50)
MW23-025 (9.1)
MW21-025 (12.1)
GP09 (0.35)
GP35 (2.8)
(18.60) GP20
(15.90) GP44
MW22-027 (13.6)
GP10 (0.27)
GP21 (12.40)
(21.40) GP37
MW20-026 (5.0)
(16.80) GP38
(24.50) GP39
GP11 (4.36)
(<0.25) GP32
MW31-034 (<0.4)
(<0.25) GP33
GP43 (0.70)
MW06-022
GP45
GP42 (0.30)
GP41 (3.2)
GP18 (2.50)
MW53-034 (3.04)
GP46 (2.49)
GP12 (<0.25)
MW29-033 (0.54)
GP40 (9.45)
MW07-024
GP25 (0.625)
GP34 (<0.25)
GP13 (<0.25)
GP14 (<0.25)
GP15 (<0.25)
GP16 (0.39)
GP36 (0.3)
GP24 (O.66)
GP26 (0.207)
GP22 (0.35)
MW32-040
GP23 (0.30) (0.84)
MW10-023
GP17 (0.39)
MW33-033 (0.25)
MW15-024
MW41-033 [0.59]
MW43-027 [9.2]
MW42-027 [22.0]
MW40-030 [1.4]
MW34-038 (35.4)
MW46-043 [0.84]
MW44-027 [3.1]
GP56 [131]
MW35-038 (<0.4)
GP65 [343]
MW14-015
GP50/SB11 (50.6)
GP27 (1.05)
GP66 [570]
MW24-010
MW45-042 [0.7]
GP28 (1.8)
MW12-021
MW02-012
GP47 (66)
MW02-034 (6.0)
GP30 (1.06)
MW01-019
MW04-019
MW25-024
GP52 (<0.4)
MW25-035 (0.25)
GP54 (0.54)
MW16-014
MW05-025
GP31 (0.256)
MW19-013
GP29
GP59 (61)
GP60 (2)
MW36-006
MW18-031
MW18-016 (0.34)
MW37-030
MW37-012 (0.33)
GP49 (0.51)
GP63 (1.6)
MW38-035
MW38-007 (<0.40)
MW17-016
MW03-017
MW17-028

Figure 20
FLUORIDE CONCENTRATION CONTOUR MAP (AUGUST 1997, JUNE AND AUGUST 1998) UPPER GRAY SAND
REYNOLDS METALS COMPANY
TROUTDALE, OREGON

CH2MHILL

Fig. 6 - Intermediate Depth Fluoride Plume

NOTE:
INTERMEDIATE-DEPTH MONITORING WELLS ARE GENERALLY SCREENED IN GRAY UNCONSOLIDATED SAND 80 TO 100 FEET BELOW GROUND SURFACE.

FLUORIDE VALUE (mg/L) IS FROM FIELD MEASUREMENT. IF LABORATORY FLUORIDE CONFIRMATION IS HIGHER, THAT VALUE IS POSTED AS INDICATED BY [ ].

FLUORIDE VALUES ARE GIVEN FOR GEOPROBE BORINGS DRILLED IN INTERMEDIATE-DEPTH SAND. OTHER GEOPROBE LOCATIONS ARE SHOWN ONLY TO INDICATE THEIR ARRANGEMENT ACROSS THE SITE

* TO TARGET AN INTERVAL SUSPECTED OF BEING CONTAMINATED, MW08-127 WAS SCREENED APPROXIMATELY 50 FEET DEEPER THAN NEARBY INTERMEDIATE-DEPTH WELLS. THEREFORE, WATER LEVEL ELEVATIONS AND CONCENTRATIONS AT THIS LOCATION MAY NOT BE COMPARABLE WITH THOSE AT NEARBY LOCATIONS.

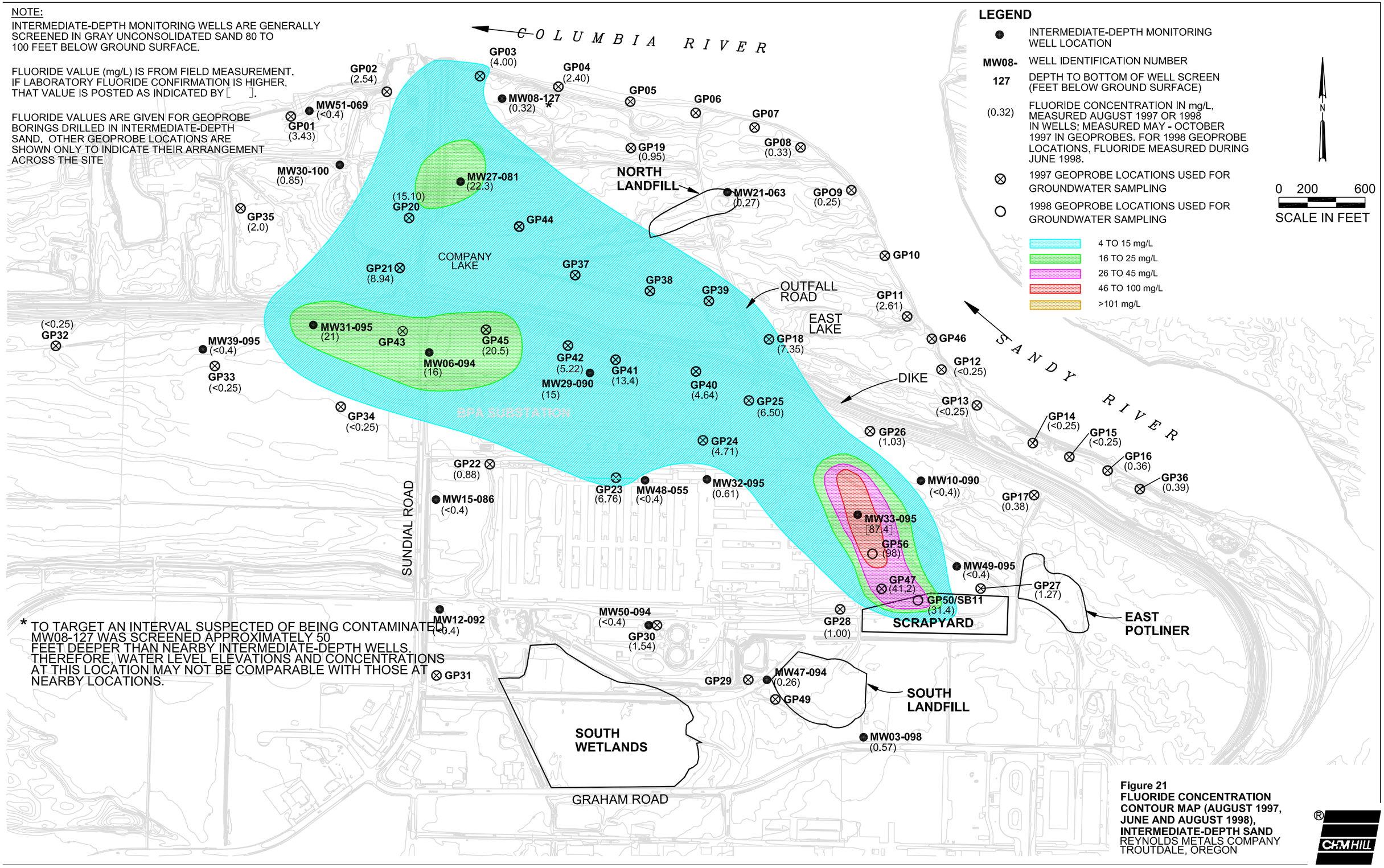


Figure 21
FLUORIDE CONCENTRATION CONTOUR MAP (AUGUST 1997, JUNE AND AUGUST 1998), INTERMEDIATE-DEPTH SAND
REYNOLDS METALS COMPANY
TROUTDALE, OREGON

CH2MHILL

04-NOV-1997 SITEMAP1.DWG

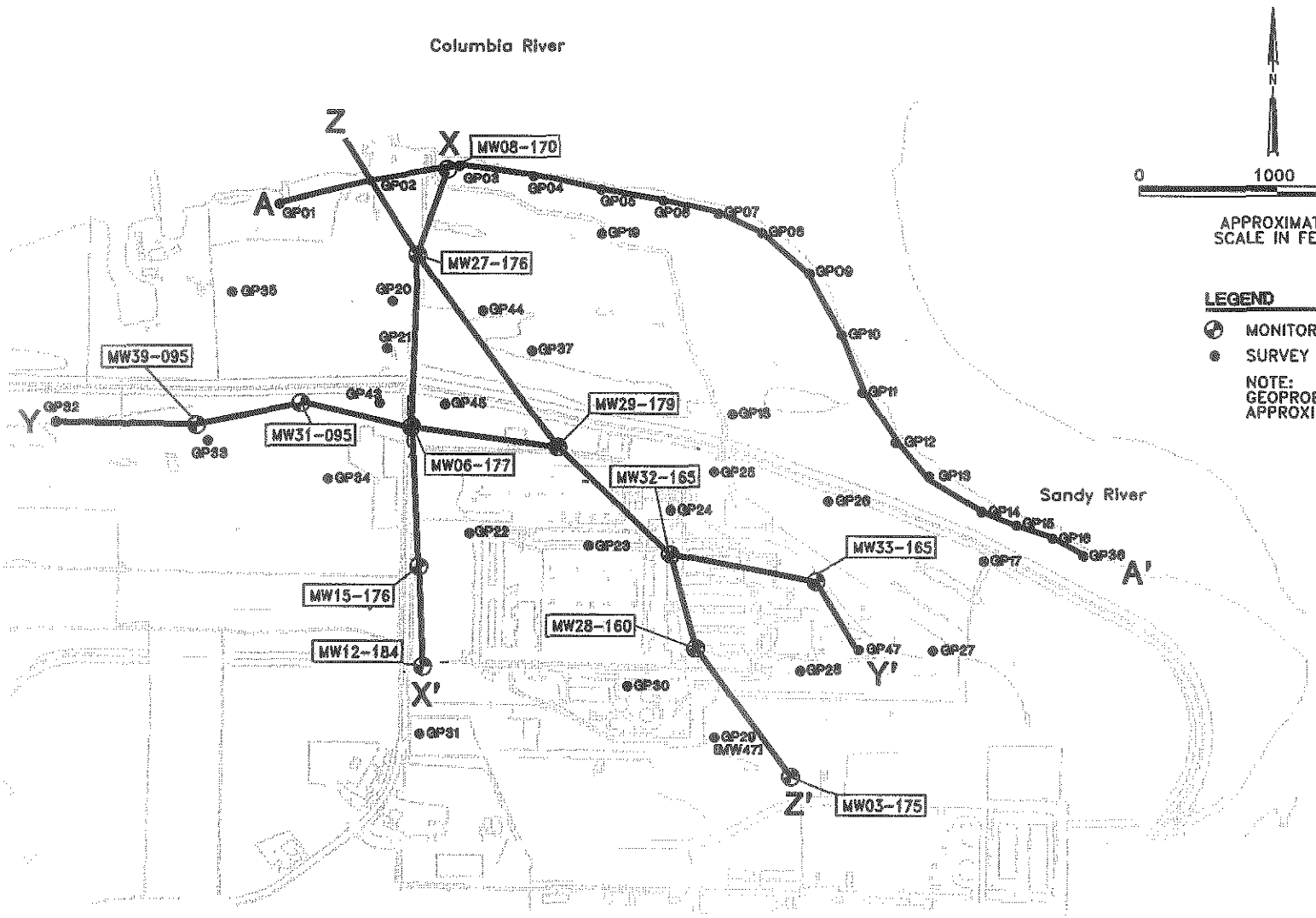


Figure 18
LOCATION MAP FOR CROSS SECTIONS SHOWING VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Tech Memorandum No. GW-12

CH2M HILL

107493.D1.08 RMC PDX 11/25/97 cb, lh

A West — COLUMBIA RIVER — SANDY RIVER PROXIMITY — A' East

GP01	GP02	GP03	GP04	GP05	GP06	GP07	GP08	GP09	GP10	GP11	GP12	GP13	GP14	GP15	GP16	GP36
0.31	<0.25	1.60	<0.25	0.41	<0.25	0.64	<0.25	<0.25	<0.25	1.99	<0.25	<0.25	<0.25	<0.25	0.27	0.26
<0.25	0.25	4.60	0.28	0.77	<0.25	0.45	<0.25	0.28	<0.25	4.36	<0.25	<0.25	<0.25	<0.25	0.29	<0.25
0.46	0.66	12.00	13.00	<0.25	0.48	0.52	0.29	<0.25	0.27	3.49	<0.25	<0.25	<0.25	<0.25	<0.25	0.29
0.37	3.09	2.50	<0.25	0.25	<0.25	<0.25	0.29	0.35	<0.25	2.61	<0.25	<0.25	<0.25	<0.25	0.39	0.30
1.24	2.54	4.00	<0.25	<0.25	<0.25	0.26	0.33	<0.25	<0.25	1.24	<0.25	<0.25	<0.25	<0.25	0.36	0.38
3.43	0.58	2.10	2.40	TD = 59' bgs	TD = 59' bgs	TD = 61' bgs	<0.25	0.25	TD = 58.9' bgs	0.91	<0.25	<0.25	<0.25	<0.25	0.27	0.39
0.33	0.42	1.00	0.61				TD = 71' bgs	TD = 69.8' bgs		TD = 73.8' bgs	<0.25	<0.25	<0.25	<0.25	0.33	0.31
0.26	1.98	2.10	TD = 79.40' bgs								<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
0.40	0.67	TD = 90.5' bgs									<0.25	<0.25	<0.25	<0.25	0.34	TD = 90.9' bgs
<0.25	TD = 102' bgs										TD = 77' bgs	<0.25	<0.25	TD = 89.9' bgs	TD = 99.1' bgs	
TD = 102' bgs												TD = 81.5' bgs	TD = 91.5' bgs			

Elevation (feet): 35, 20, 5, -10, -25, -40, -55, -70, -85

Horizontal Distance (feet): 0, 500, 1,000, 1,500, 2,000, 2,500, 3,000, 3,500, 4,000, 4,500, 5,000, 5,500, 6,000, 6,500

LEGEND

GP01 — Geoprobe I.D. # (Locations are approximate)

0.31 mg/L (Field fluoride value (mg/L) = 0.31)

TD = 102' bgs (Total Geoprobe depth in feet below (approximate) ground surface elevation)

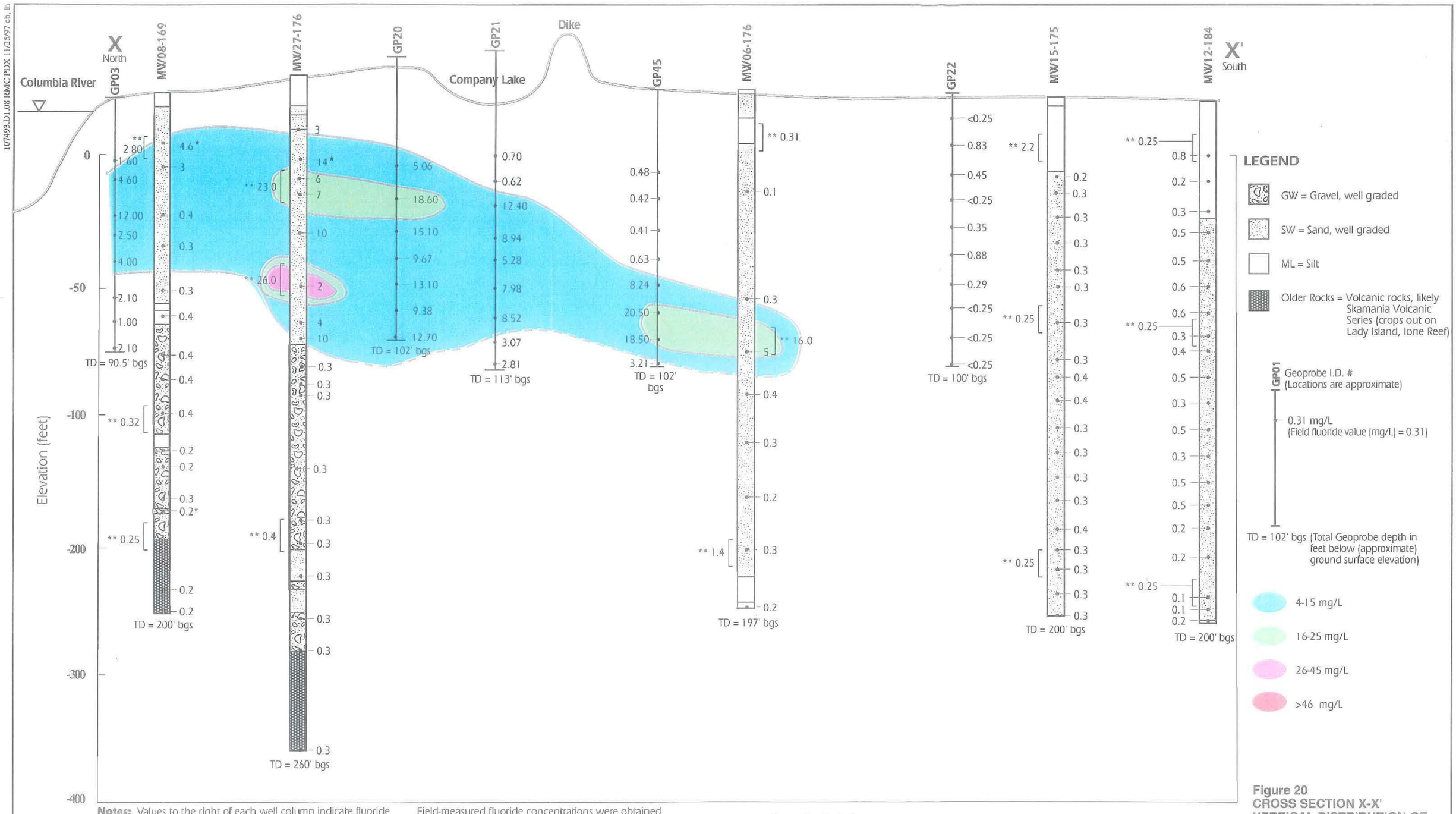
4-15 mg/L

Notes: Field-measured fluoride concentrations (mg/L) were obtained during summer 1997 (Geoprobes).

Approximate Scales:
Horizontal scale: **1 inch = 500 feet**
Vertical scale: **1 inch = 15 feet**
Vertical exaggeration: **33x**
Elevation relative to the 1929 NGVD

Figure 19
CROSS SECTION A-A'
VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
TECHNICAL MEMORANDUM NO. GW-12

CH2MHILL



Notes: Values to the right of each well column indicate fluoride readings taken during drilling of the identified well; note that in most cases the well column actually represents a group of wells, whose screen intervals are indicated by a bracket to the left of the column (see Table 1 for well-specific information).

Field-measured fluoride concentrations were obtained by screening borehole water samples with an Orion fluoride probe during Phase 1 and Phase 1A drilling (April 1996 to December 1996) and during the Geoprobe investigation (summer 1997).

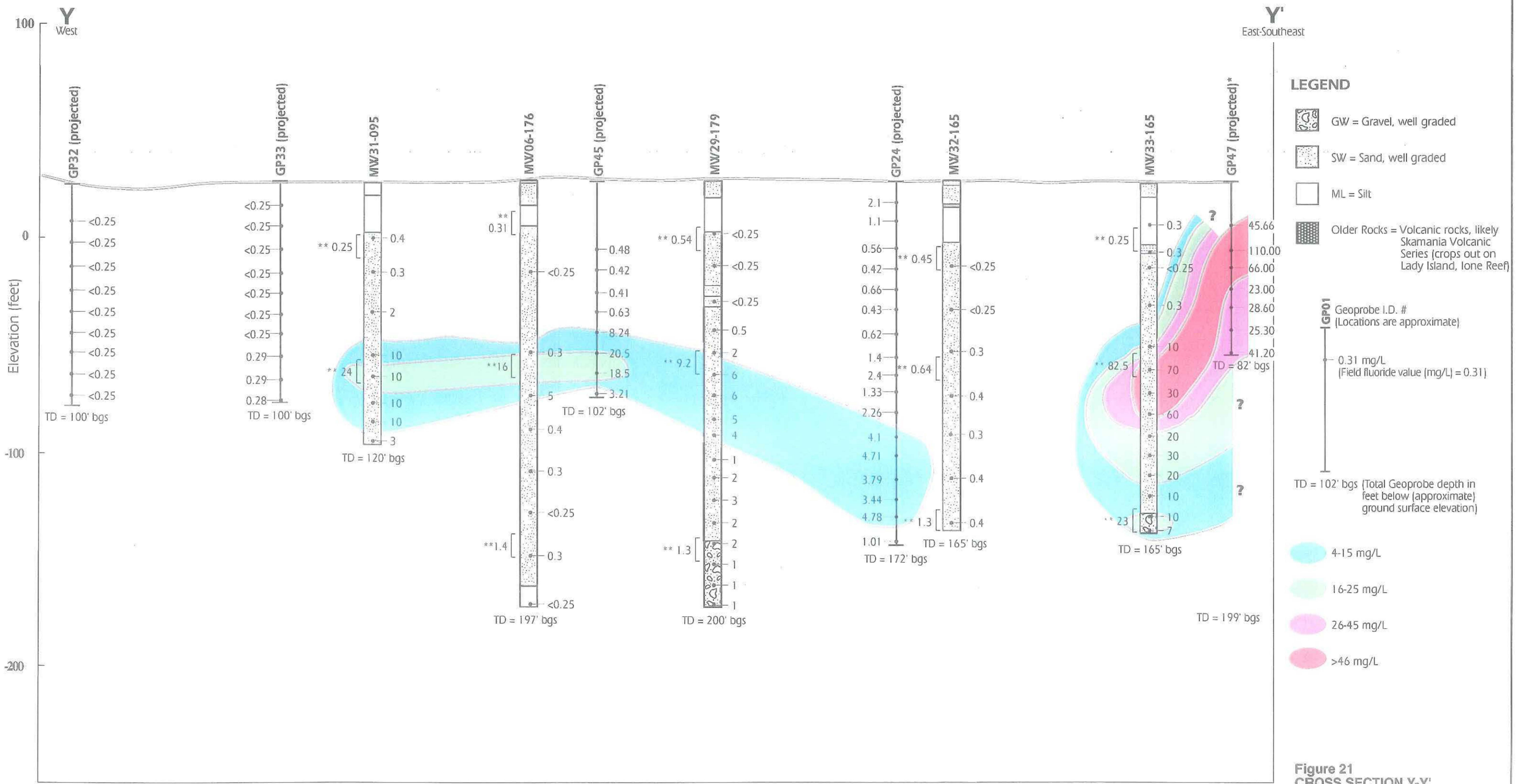
* November 1996 fluoride concentration from MW27-045 monitoring well.

** August 1997 fluoride concentration data (mg/L).

Approximate Scales:
Horizontal scale: **1 inch = 400 feet**
Vertical scale: **1 inch = 33 feet**
Vertical exaggeration: **12x**
Elevation relative to the 1929 NGVD

Figure 20
CROSS SECTION X-X'
VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
TECHNICAL MEMORANDUM
NO. GW-12

CH2MHILL



Notes: Values to the right of each well column indicate fluoride readings taken during drilling of the identified well; note that in most cases the well column actually represents a group of wells, whose screen intervals are indicated by a bracket to the left of the column (see Table 1 for well-specific information).

Field-measured fluoride concentrations were obtained by screening borehole water samples with an Orion fluoride probe during Phase 1 and Phase 1A drilling (April 1996 to December 1996) and during the Geoprobe investigation (summer 1997).

* Note that the fluoride distribution shown in MW33 and GP47 is localized. See Figure 16 for the southern extent of fluoride.

** August 1997 fluoride concentration data (mg/L).

Approximate Scales:

Horizontal scale: **1 inch = 500 feet**

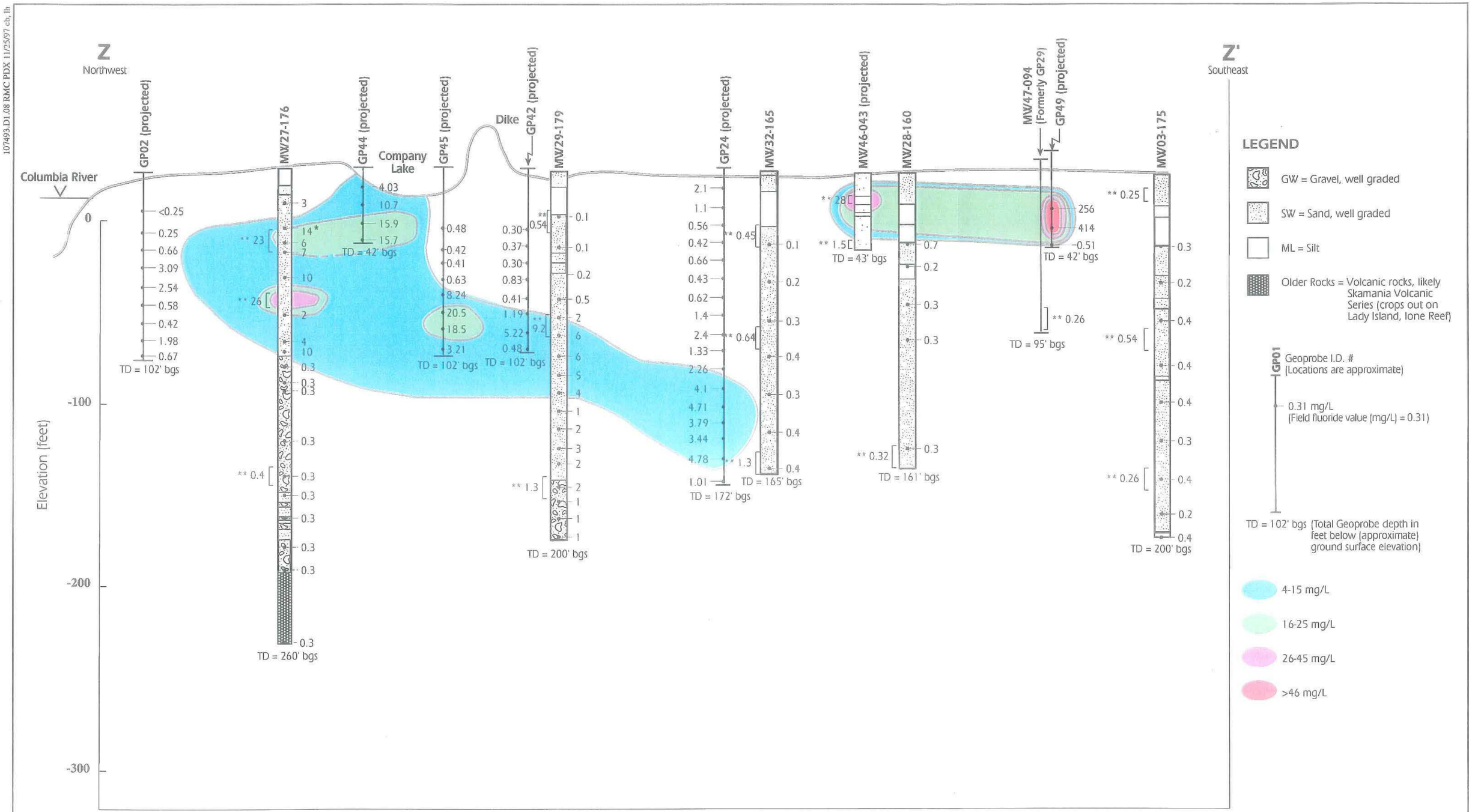
Vertical scale: **1 inch = 45 feet**

Vertical exaggeration: **11x**

Elevation relative to the 1929 NGVD

Figure 21
CROSS SECTION Y-Y'
VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
TECHNICAL MEMORANDUM NO. GW-12

CH2MHILL



Notes: Values to the right of each well column indicate fluoride readings taken during drilling of the identified well; note that in most cases the well column actually represents a group of wells, whose screen intervals are indicated by a bracket to the left of the column (see Table 1 for well-specific information).

Field-measured fluoride concentrations were obtained by screening borehole water samples with an Orion fluoride probe during Phase 1 and Phase 1A drilling (April 1996 to December 1996) and during the Geoprobe investigation (summer 1997).

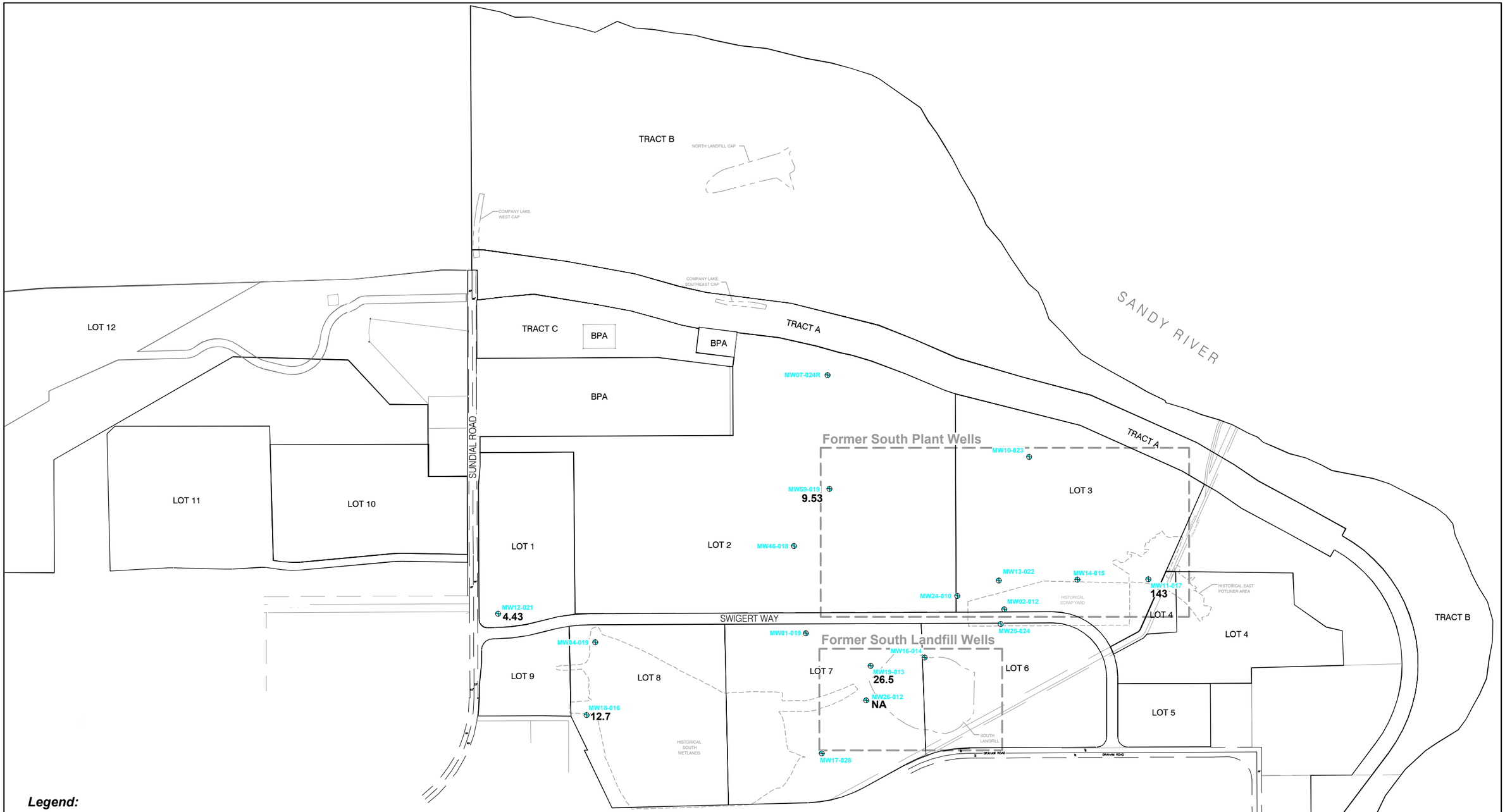
* November 1996 fluoride concentration from MW27-045 monitoring well.

** August 1997 fluoride concentration data (mg/L).

Approximate Scales:
Horizontal scale: **1 inch = 500 feet**
Vertical scale: **1 inch = 50 feet**
Vertical exaggeration: **10x**
Elevation relative to the 1929 NGVD

Figure 22
CROSS SECTION Z-Z'
VERTICAL DISTRIBUTION OF FIELD-MEASURED FLUORIDE
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
TECHNICAL MEMORANDUM
NO. GW-12

CH2M HILL



Legend:

MW59-019 ⊕ Groundwater Monitoring Well (Silt Zone)

9.53 Fluoride Concentration in mg/L

NA Not Analyzed

NOTE: Base map prepared from plat plan provided by Port of Portland.

N

0 600 1,200

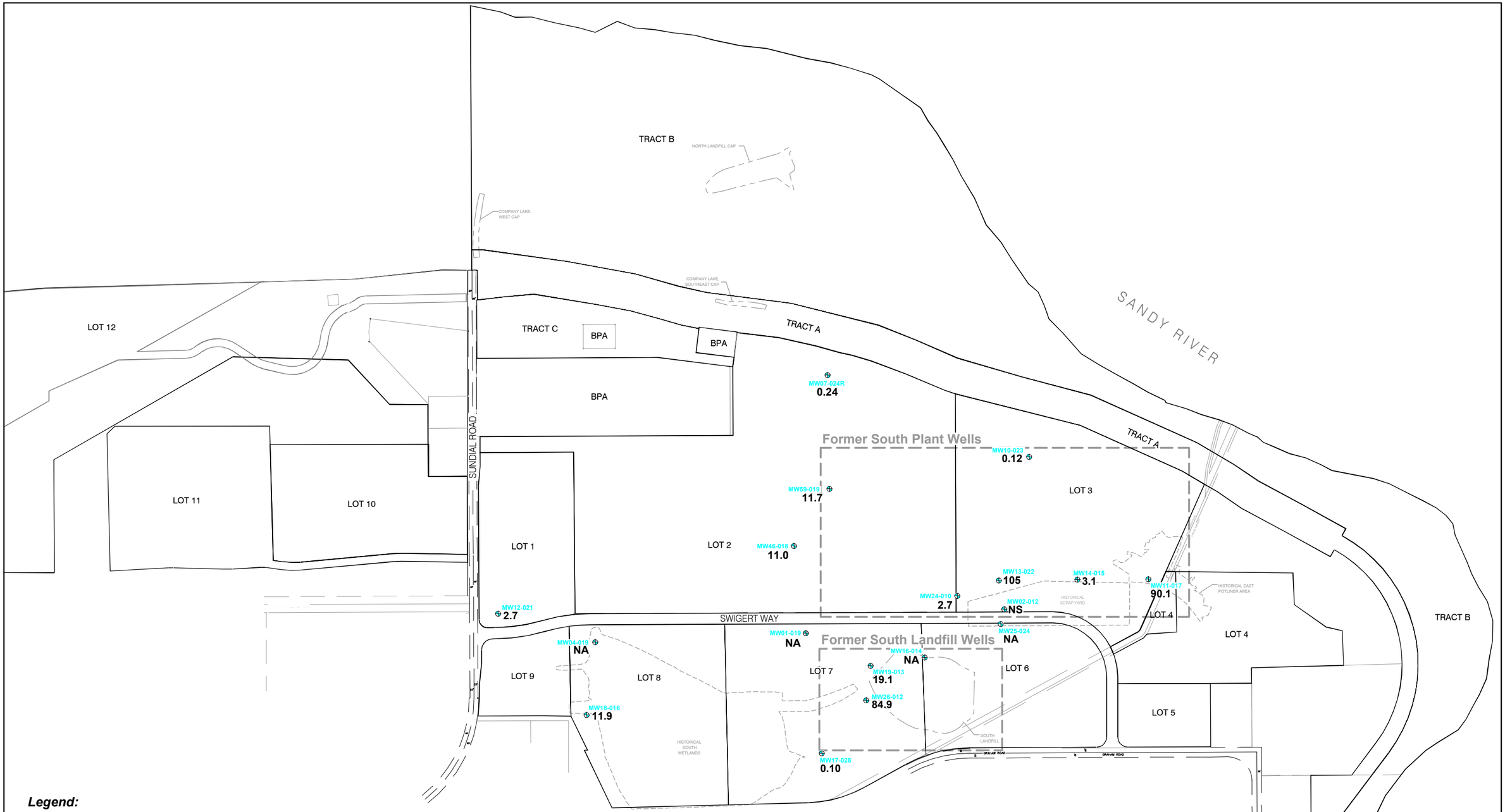
Scale in Feet

Silt Zone Fluoride Concentrations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		12



Legend:

MW59-019 ⊕ Groundwater Monitoring Well (Silt Zone)
11.7 Fluoride Concentration in mg/L

NA Not Analyzed

NS Not Sampled

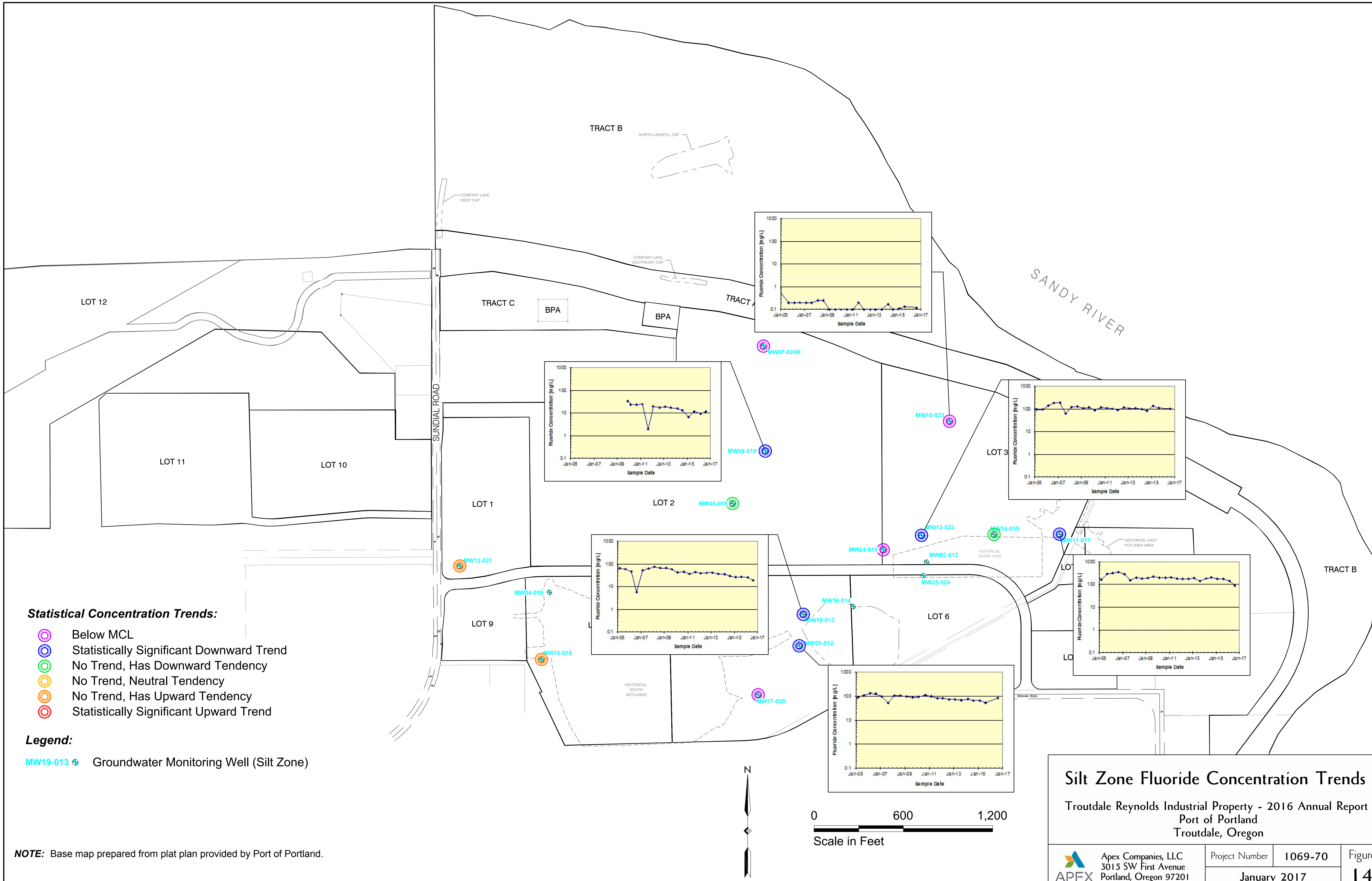
NOTE: Base map prepared from plat plan provided by Port of Portland.

Silt Zone Fluoride Concentrations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		13

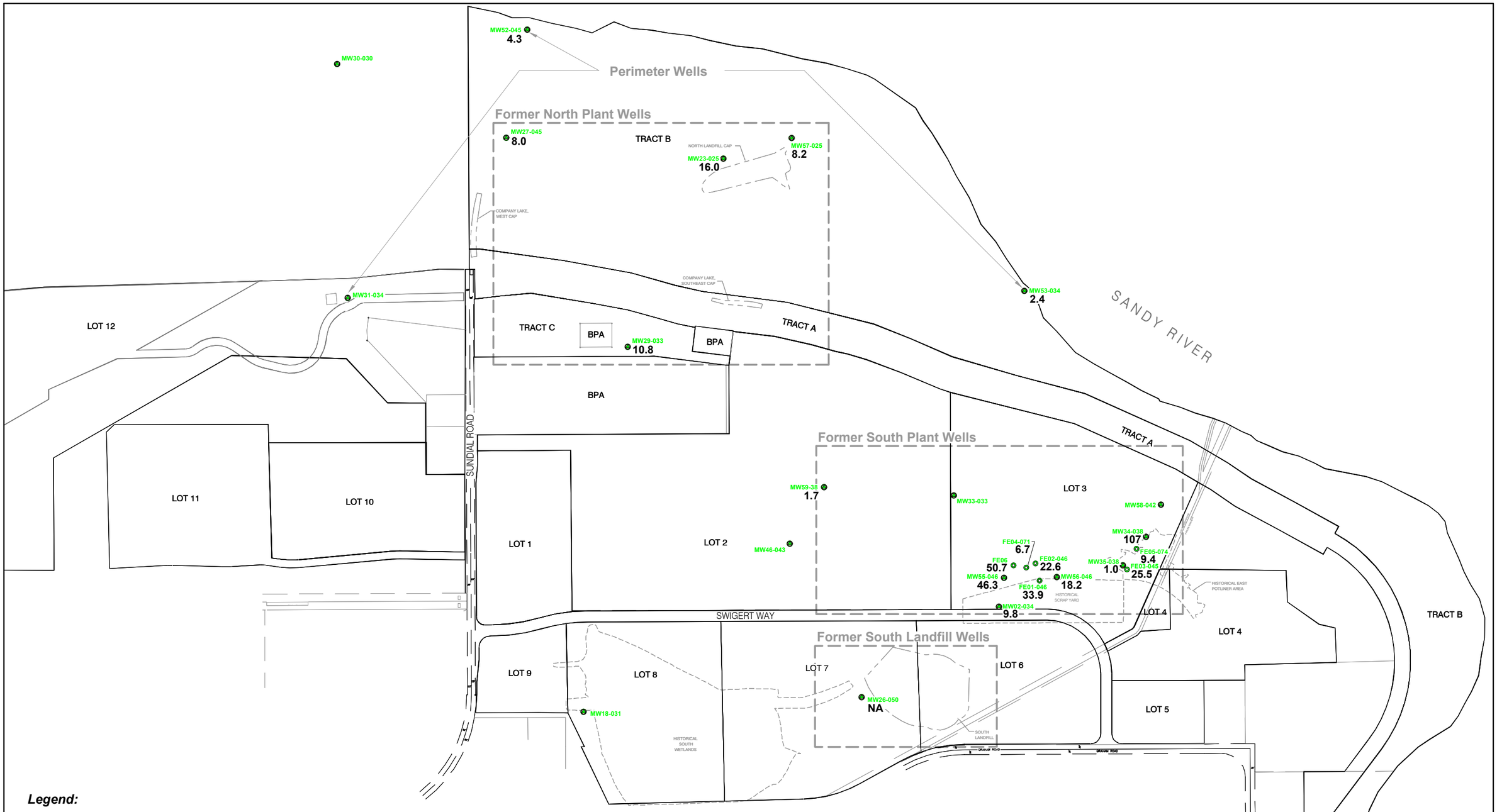


NOTE: Base map prepared from plat plan provided by Port of Portland.

Silt Zone Fluoride Concentration Trends

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX — Apex Companies, LLC, 3015 SW First Avenue, Portland, Oregon 97201	Project Number 1069-70	January 2017	Figure 14



Legend:

MW02-034 Groundwater Monitoring Well (UGS Zone)
9.8 Fluoride Concentration in mg/L

NA Not Analyzed

FE01 Focused Extraction Well

NOTE: Base map prepared from plat plan provided by Port of Portland.

N

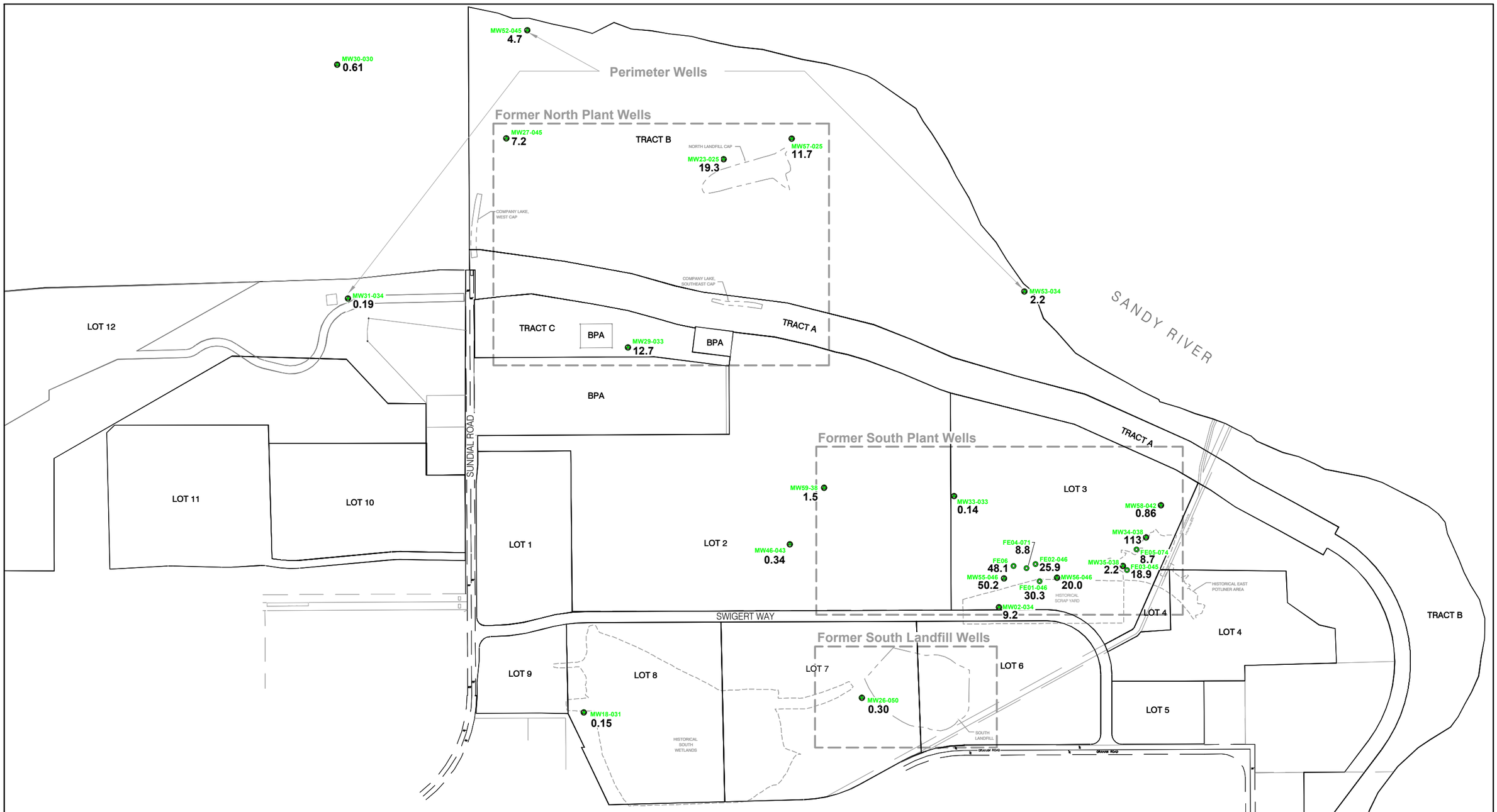
0 600 1,200
Scale in Feet

Upper Gray Sand Zone Fluoride Concentrations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		15



Legend:

MW02-034 / 9.2 — Groundwater Monitoring Well (UGS Zone) Fluoride Concentration in mg/L

FE01 — Focused Extraction Well

NOTE: Base map prepared from plat plan provided by Port of Portland.

N

0 600 1,200

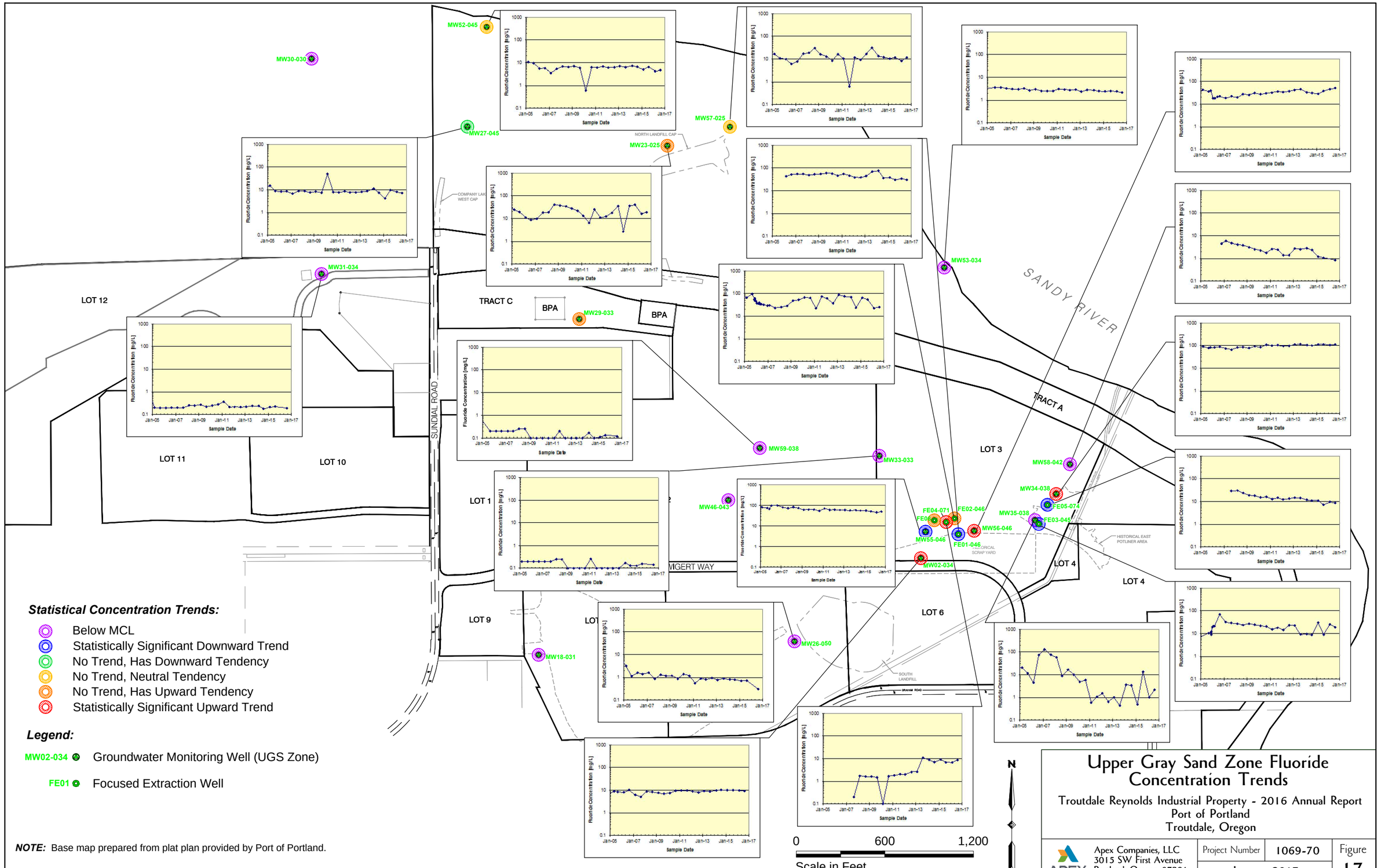
Scale in Feet

Upper Gray Sand Zone Fluoride Concentrations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		16



Statistical Concentration Trends:

- Below MCL
- Statistically Significant Downward Trend
- No Trend, Has Downward Tendency
- No Trend, Neutral Tendency
- No Trend, Has Upward Tendency
- Statistically Significant Upward Trend

Legend:

MW02-034 — Groundwater Monitoring Well (UGS Zone)

FE01 — Focused Extraction Well

NOTE: Base map prepared from plat plan provided by Port of Portland.

0 600 1,200

Scale in Feet

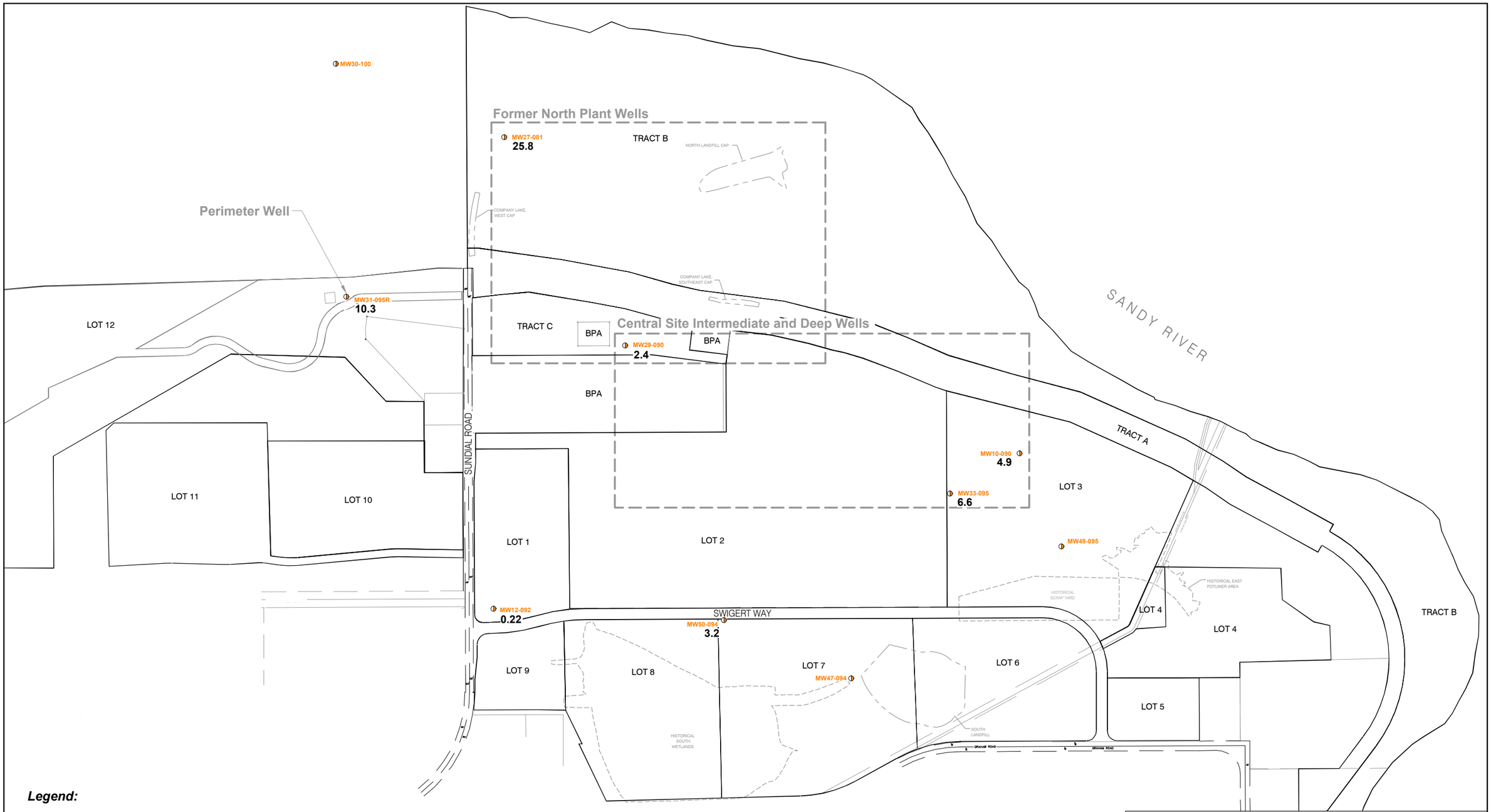
N

Upper Gray Sand Zone Fluoride Concentration Trends

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		17



Legend:

MW33-095 Groundwater Monitoring Well (Intermediate Zone)
6.6 Fluoride Concentration in mg/L

N

0 600 1,200
Scale in Feet

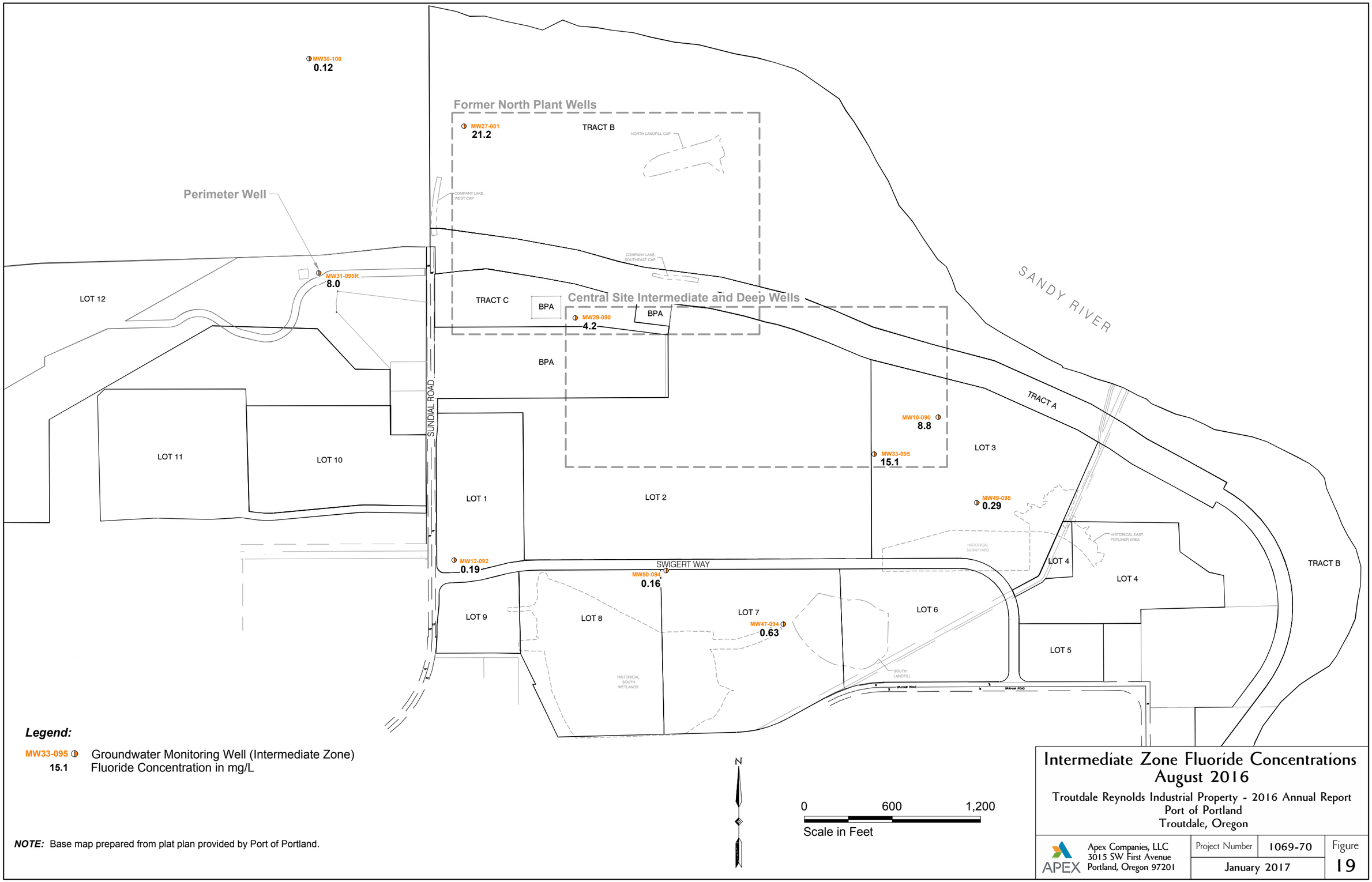
NOTE: Base map prepared from plat plan provided by Port of Portland.

Intermediate Zone Fluoride Concentrations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		18



Legend:

MW33-095 Groundwater Monitoring Well (Intermediate Zone)
15.1 Fluoride Concentration in mg/L

N

0 600 1,200
Scale in Feet

NOTE: Base map prepared from plat plan provided by Port of Portland.

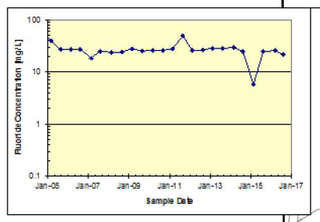
Intermediate Zone Fluoride Concentrations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		19

MW30-100



MW27-081

TRACT B

NORTH LANDFILL CAP

COMPANY LAKE, WEST CAP

COMPANY LAKE, SOUTHEAST CAP

MW31-095R

LOT 12

TRACT C

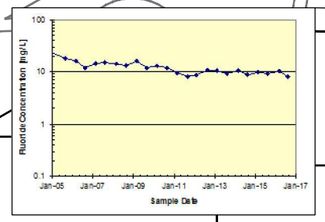
BPA

BPA

MW29-090

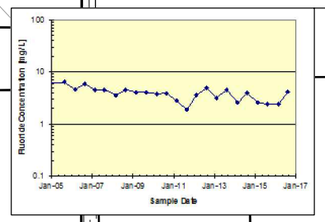
TRACT A

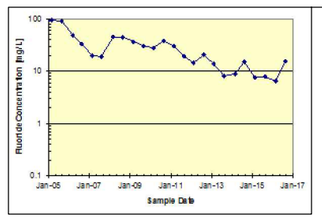
SANDY RIVER



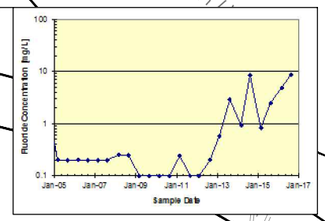
LOT 11

LOT 10





MW33-095



MW10-090

LOT 3

MW49-095

LOT 1

LOT 2

HISTORICAL SCRAP YARD

HISTORICAL EAST POTLINER AREA

LOT 4

LOT 4

TRACT B

MW12-092

SWIGERT WAY

MW15-094

LOT 9

LOT 8

LOT 7

MW47-094

LOT 6

LOT 5

HISTORICAL SOUTH WETLANDS

SOUTH LANDFILL

GRAHAM ROAD

GRAHAM ROAD

Statistical Concentration Trends:

- Below MCL
- Statistically Significant Downward Trend
- No Trend, Has Downward Tendency
- No Trend, Neutral Tendency
- No Trend, Has Upward Tendency
- Statistically Significant Upward Trend

Legend:

MW33-095 Groundwater Monitoring Well (Intermediate Zone)

N

0 600 1,200

Scale in Feet

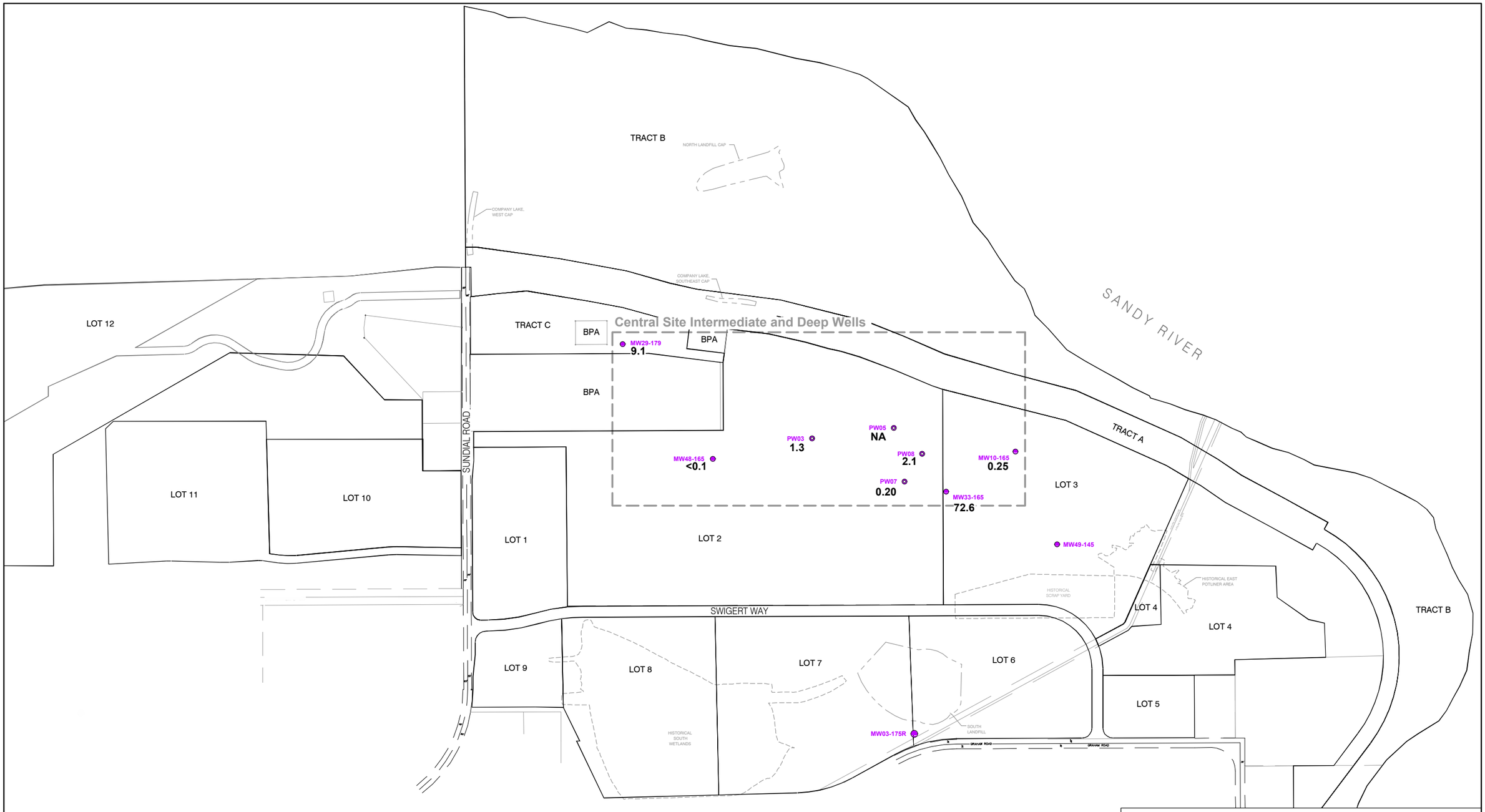
NOTE: Base map prepared from plat plan provided by Port of Portland.

Intermediate Zone Fluoride Concentration Trends

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		20



Legend:

MW33-165 ● 72.6	Groundwater Monitoring Well (Deep Zone) Fluoride Concentration in mg/L
NA	Not Analyzed
PW03 ⊙	Production Well

NOTE: Base map prepared from plat plan provided by Port of Portland.

N

0 600 1,200

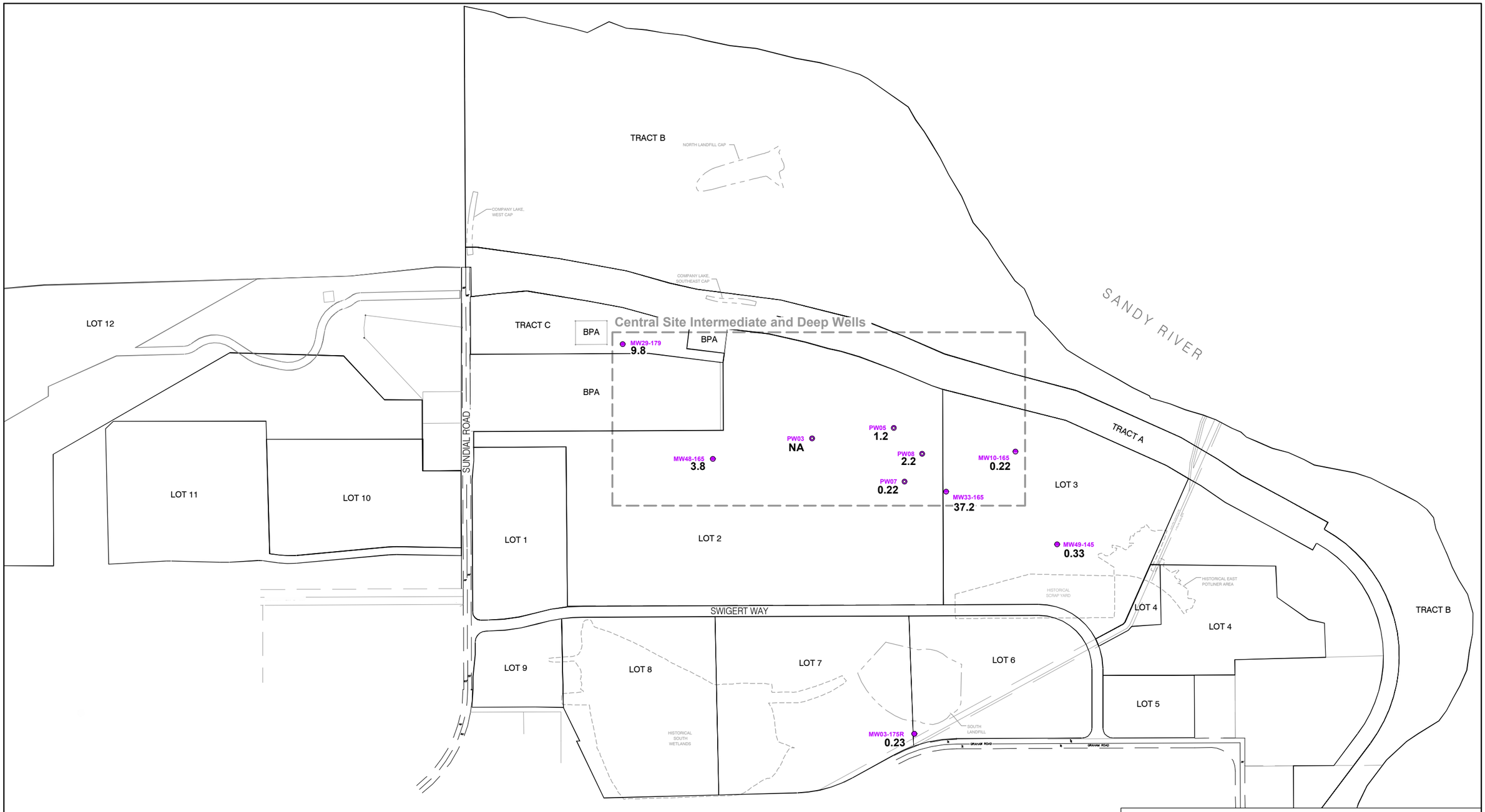
Scale in Feet

Deep Zone Fluoride Concentrations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		21



Legend:

MW33-165 ● Groundwater Monitoring Well (Deep Zone)
37.2 Fluoride Concentration in mg/L

NA Not Analyzed

PW03 ⊙ Production Well

NOTE: Base map prepared from plat plan provided by Port of Portland.

N

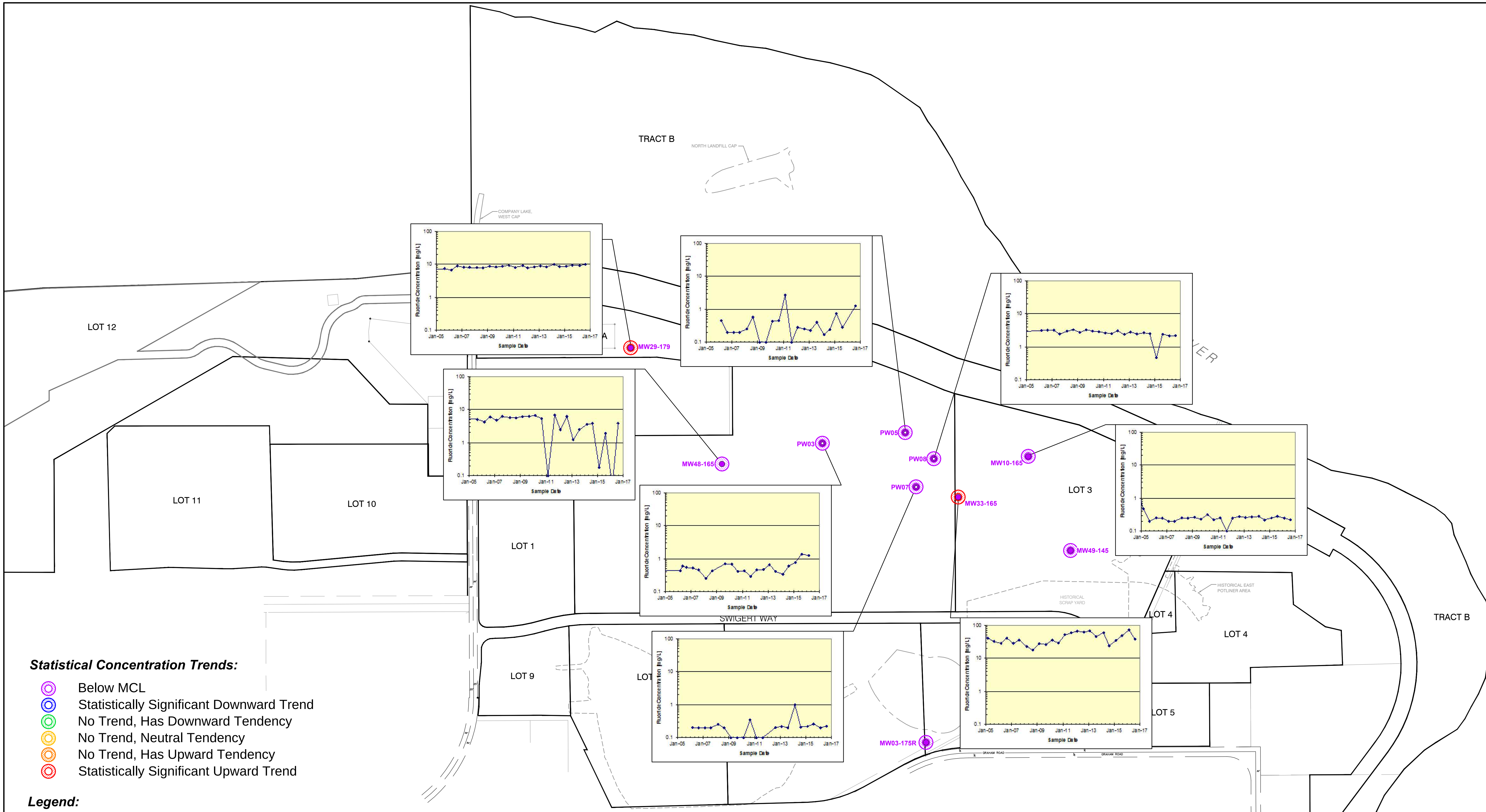
0 600 1,200
Scale in Feet

Deep Zone Fluoride Concentrations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		22



Statistical Concentration Trends:

- Below MCL
- Statistically Significant Downward Trend
- No Trend, Has Downward Tendency
- No Trend, Neutral Tendency
- No Trend, Has Upward Tendency
- Statistically Significant Upward Trend

Legend:

MW33-165 ● Groundwater Monitoring Well (Deep Zone)

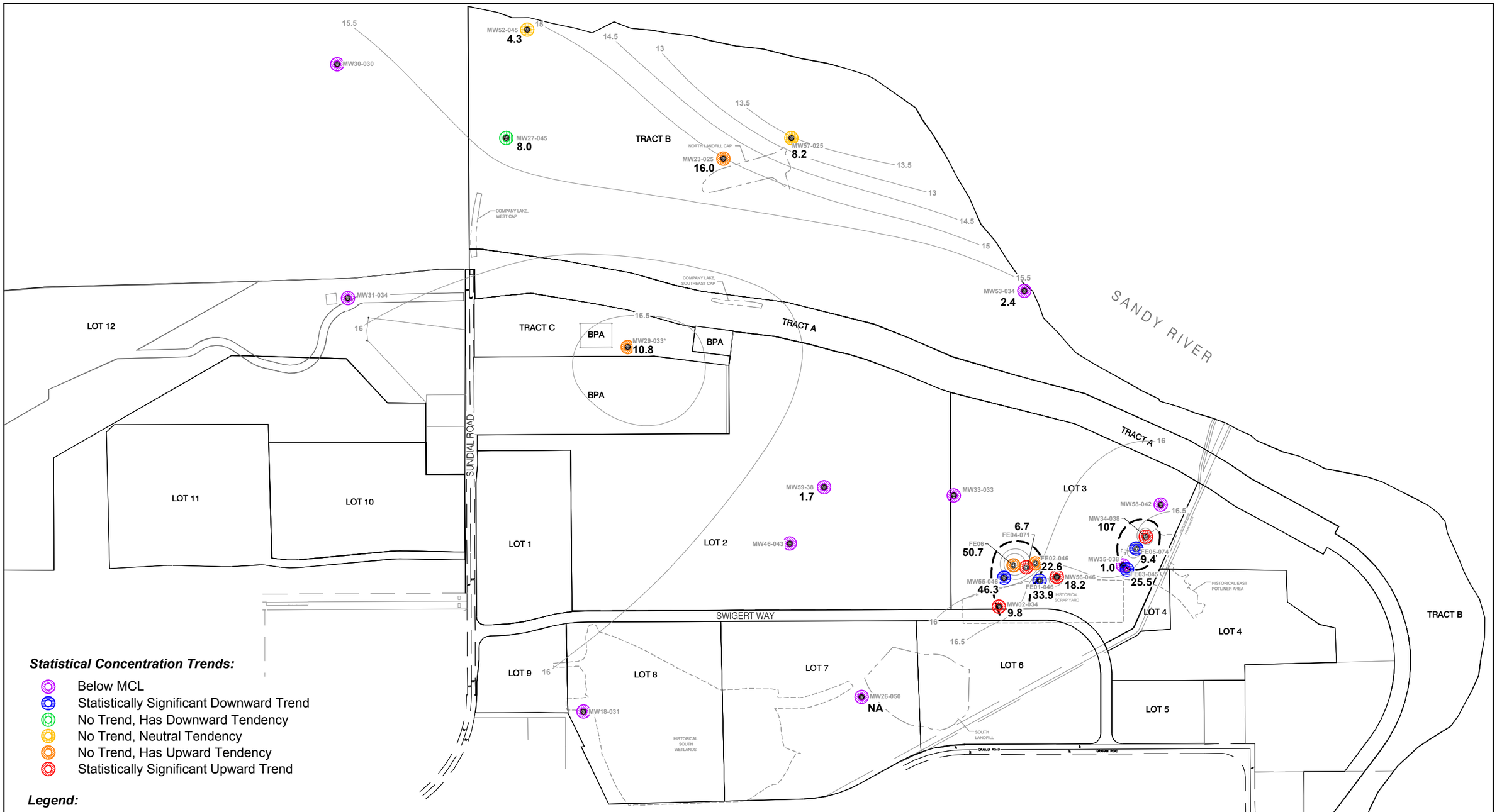
PW03 ◉ Production Well

NOTE: Base map prepared from plat plan provided by Port of Portland.

Deep Zone Fluoride Concentration Trends

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX — Apex Companies, LLC, 3015 SW First Avenue, Portland, Oregon 97201	Project Number	1069-70	Figure 23
	January 2017		



Statistical Concentration Trends:

- Below MCL
- Statistically Significant Downward Trend
- No Trend, Has Downward Tendency
- No Trend, Neutral Tendency
- No Trend, Has Upward Tendency
- Statistically Significant Upward Trend

Legend:

- Estimated Pumping Well Capture Zone (UGS Zone)
- MW02-034 / 9.8 — Groundwater Monitoring Well (UGS Zone) Fluoride Concentration in mg/L
- FE01 — Focused Extraction Well
- 15 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

NOTE: Base map prepared from plat plan provided by Port of Portland.

N

0 600 1,200

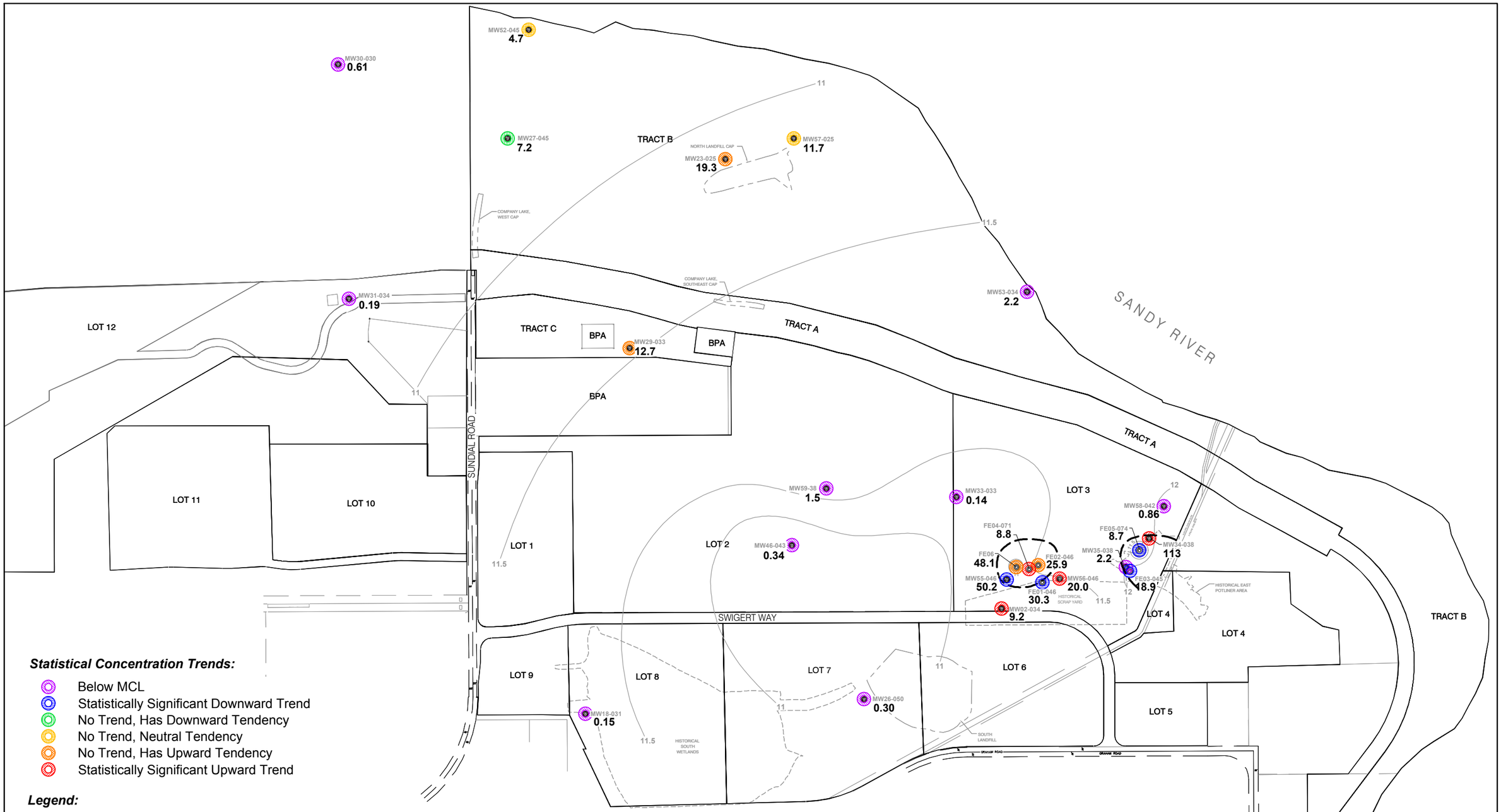
Scale in Feet

Upper Gray Sand Zone - FE System Capture Zone Assessment - February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		24



Statistical Concentration Trends:

- Below MCL
- Statistically Significant Downward Trend
- No Trend, Has Downward Tendency
- No Trend, Neutral Tendency
- No Trend, Has Upward Tendency
- Statistically Significant Upward Trend

Legend:

- Estimated Pumping Well Capture Zone (UGS Zone)
- MW02-034 / 9.2 — Groundwater Monitoring Well (UGS Zone) Fluoride Concentration in mg/L
- FE01 — Focused Extraction Well
- 11 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

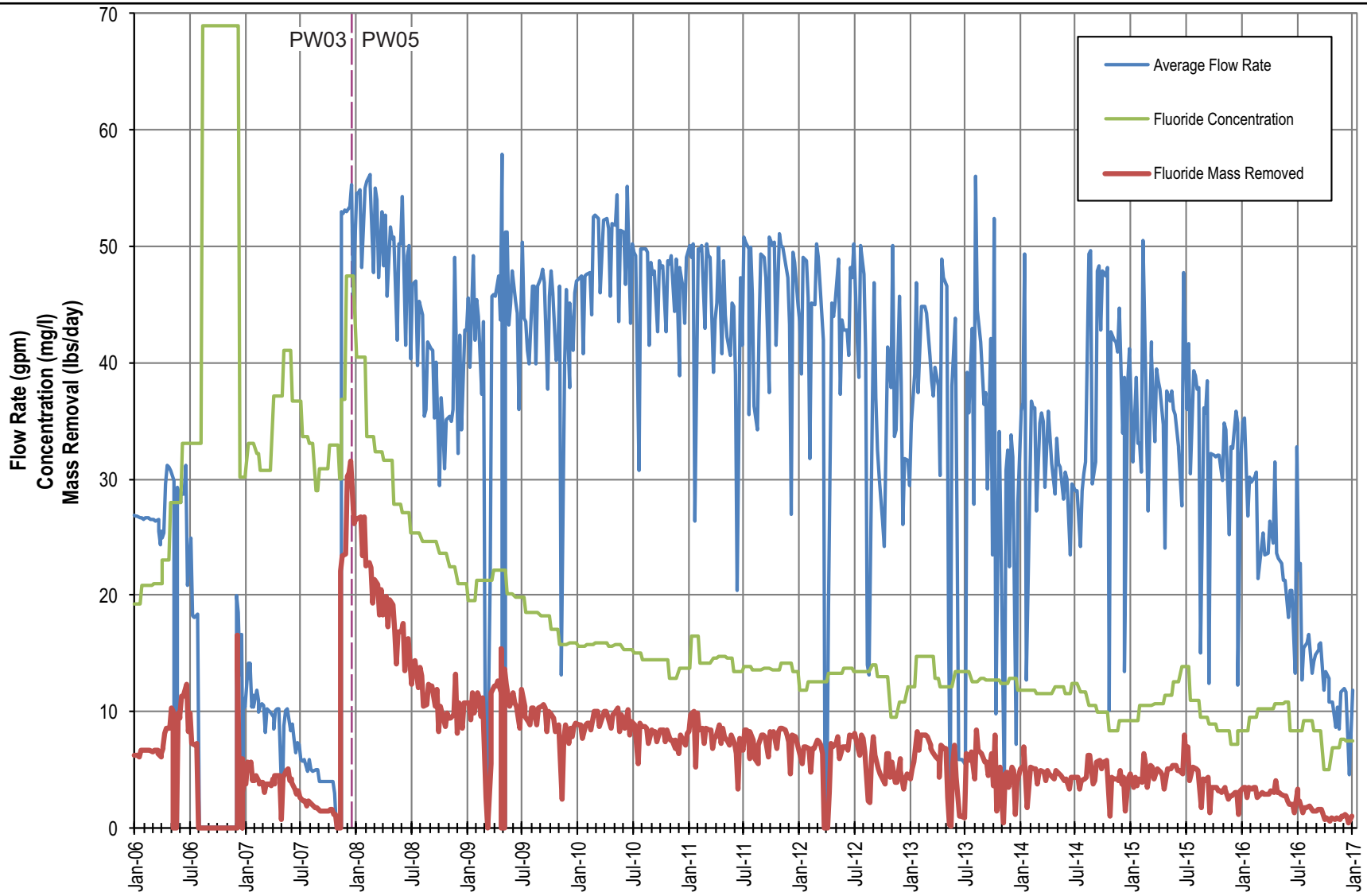
NOTE: Base map prepared from plat plan provided by Port of Portland.

Upper Gray Sand Zone - FE System Capture Zone Assessment - August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		25

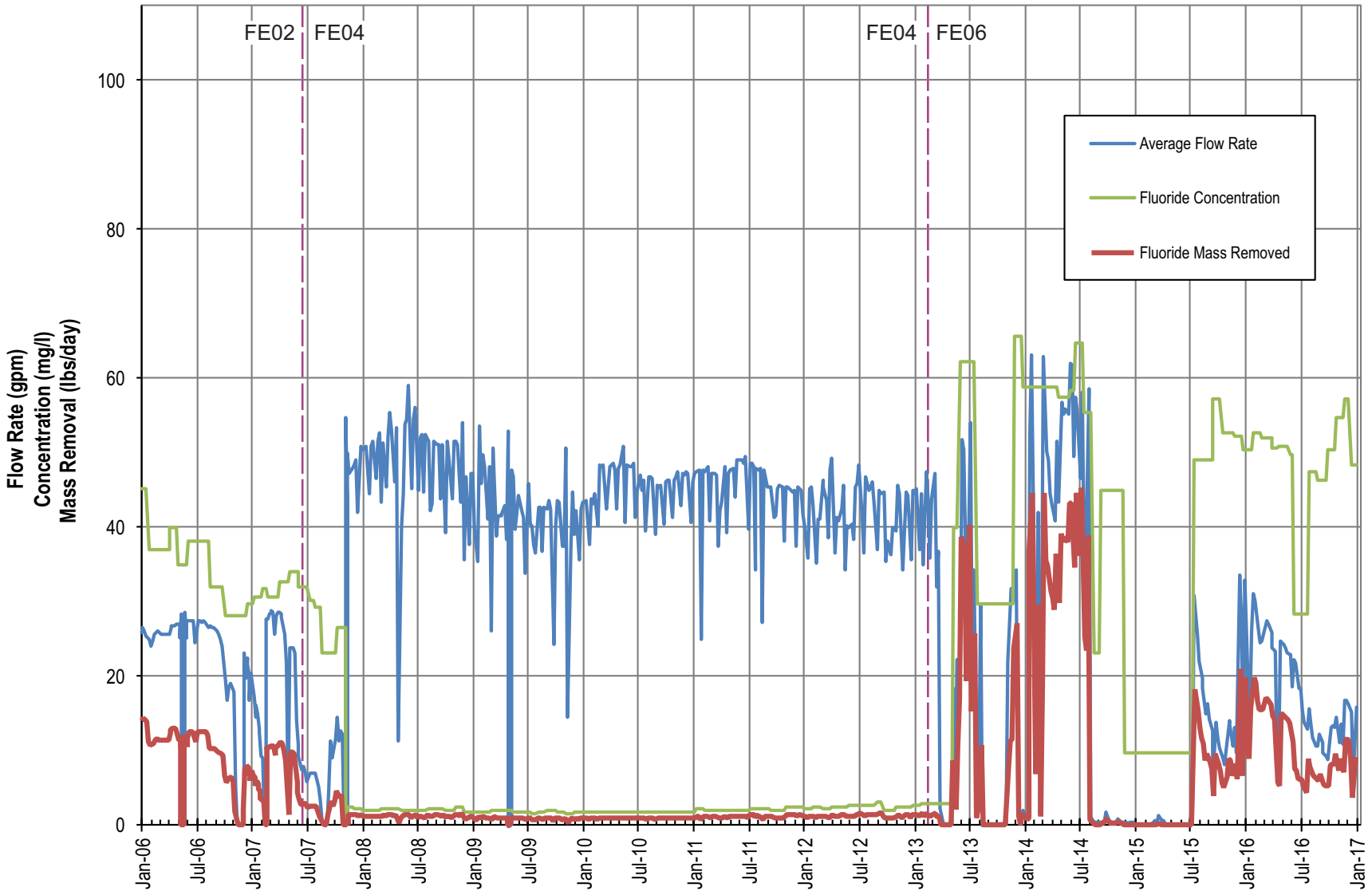


System Operation: Well FE05

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		26

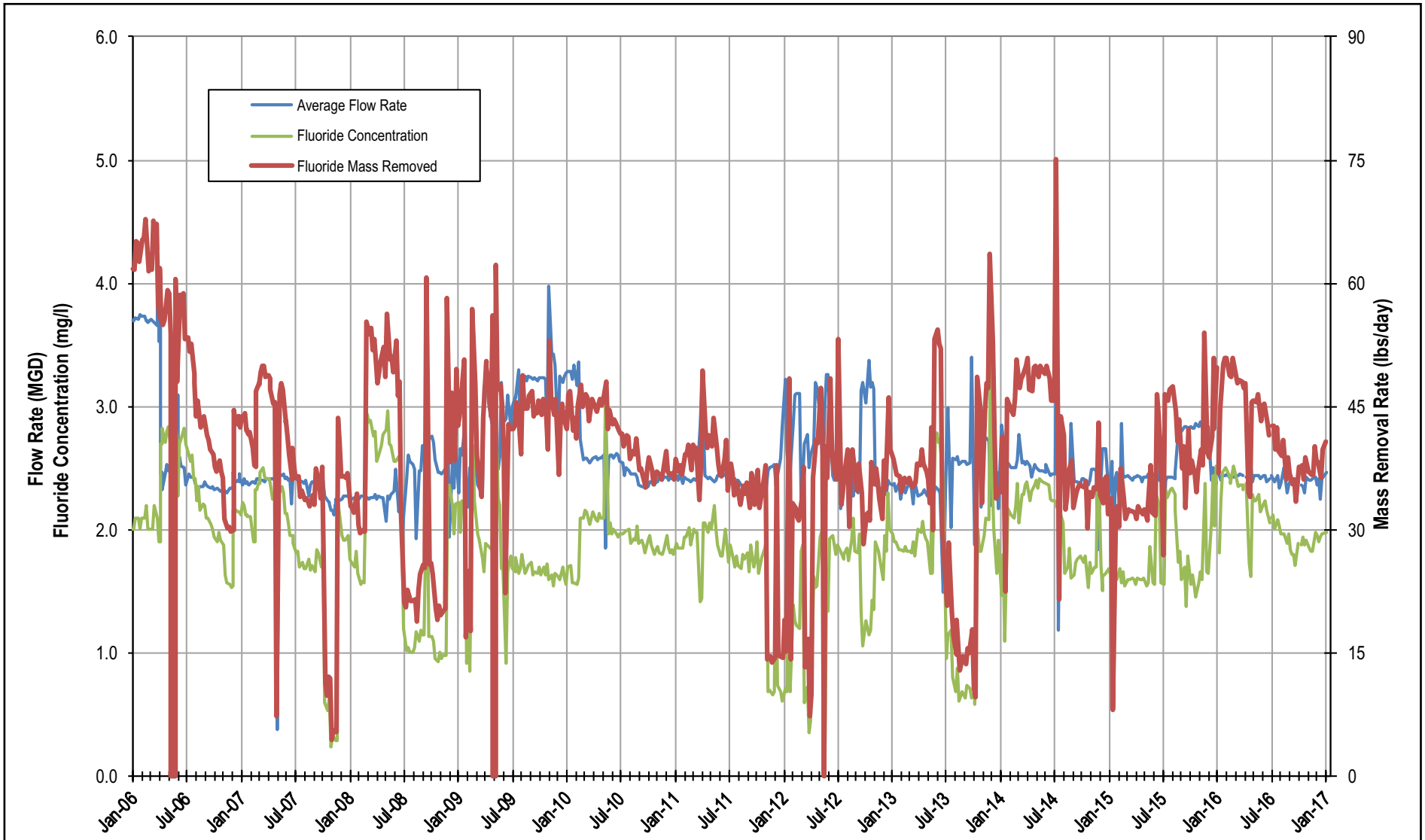


System Operation: Well FE06

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2017		27

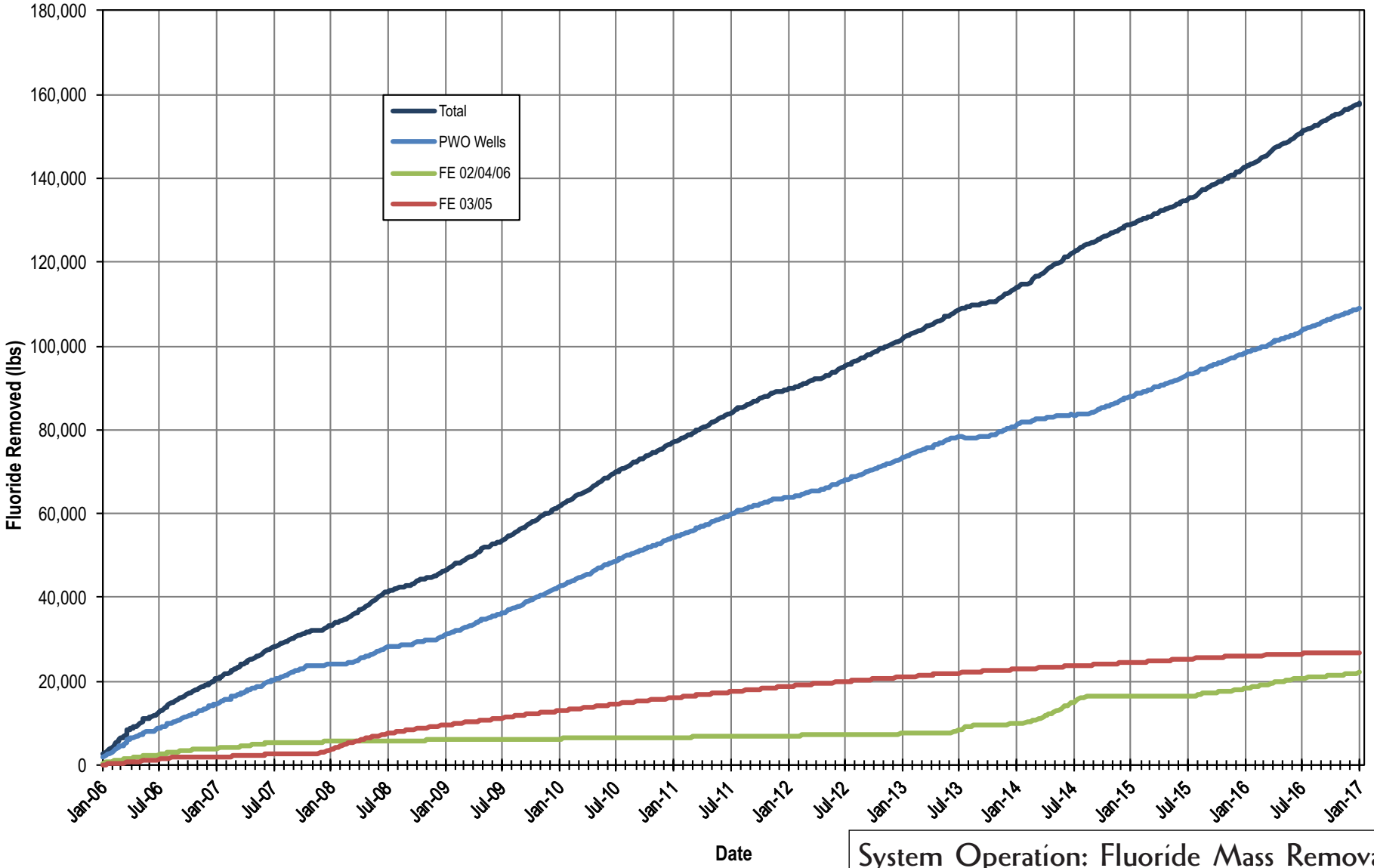


System Operation: PWO Wells

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2017		28



System Operation: Fluoride Mass Removal

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		29

APPENDIX C:

POTENTIOMETRIC SURFACE MAPS

NOTE:
MONITORING WELLS NORTH OF COMPANY LAKE PRIMARILY SCREEN GRAY SAND. LITTLE SILT IS OBSERVED IN THE SHALLOW SUBSURFACE NORTH OF THE COE FLOOD CONTROL DIKE.

LEGEND
- ● LOCATION OF SHALLOW MONITORING WELLS SCREENING SILT
- MW08- WELL IDENTIFICATION NUMBER
- 027 DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
- (10.53) WATER LEVEL ELEVATION MEASURED AUGUST 6, 1997
- 14 WATER LEVEL ELEVATION CONTOUR LINE (LOCATION APPROXIMATE)
- ▲ SURFACE WATER STAFF GAUGE LOCATION
- CONTOUR INTERVAL = 2 FEET
- ELEVATIONS ARE IN FEET ABOVE THE 1929 NGVD

N

0 200 600
SCALE IN FEET

COLUMBIA RIVER
(10.72)
SANDY RIVER
COMPANY LAKE
EAST LAKE
OUTFALL ROAD
BPA SUBSTATION
DIKE
SUNDIAL ROAD
SALMON CREEK
GRAHAM ROAD

MW08-027 (10.53)
MW27-045 (11.13)
MW09-030 (11.30)
MW21-025 (11.32)
MW23-025 (11.76)
MW22-027 (11.97)
MW20-026 (12.52)
MW06-024 (12.63)
MW07-024 (20.80)
MW10-023 (20.33)
MW15-024 (14.65)
MW41-029 (15.08)
MW43-015
MW40-018
MW42-013 (16.01)
MW44-011 (17.88)
MW46-018 (16.26)
MW45-017 (16.47)
MW13-022 (15.33)
MW14-015 (23.47)
SG01
MW11-017 (23.87)
MW12-021 (13.22)
MW02-012 (19.16)
MW24-010 (20.76)
MW01-019
SG04
SG03
MW25-024 (19.56)
SG02
MW04-019 (14.81)
MW16-014 (21.04)
MW05-025 (25.09)
MW36-006 (14.64)
MW19-013 (19.65)
SG05
MW26-012 (19.70)
SG08
SG07
MW18-016 (14.08)
SG06
MW37-012 (13.74)
MW38-007 (15.21)
MW17-016 (15.44)
MW03-017 (23.72)

Figure 23
AUGUST 1997 WATER LEVEL ELEVATION CONTOUR MAP, SHALLOW MONITORING WELLS SCREENING SILT
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. CW-12

CH2M HILL

SR8 9293WL2E.DWG
24-NOV-1997

COLUMBIA RIVER
(10.72)

MW08-027
(10.53)

MW30-030
(11.38)

MW27-045
(11.13)

MW09-030
(11.30)

MW21-025
(11.32)

MW23-025
(11.76)

MW22-027
(11.97)

MW20-026
(12.52)

COMPANY LAKE (NM)

OUTFALL ROAD

EAST LAKE

MW31-034
(11.18)

MW29-033
(12.28)

DIKE

BPA SUBSTATION

SUNDIAL ROAD

MW32-040
(12.78)

MW41-033
(13.53)

MW40-030
(13.17)

MW46-043
(11.64)

MW43-027
(14.69)

MW33-033
(11.76)

MW42-027
(14.45)

MW44-027
(13.43)

MW35-038
(11.62)

MW34-038
(11.50)

MW45-042
(11.72)

MW02-034 (11.99)

MW25-035
(12.00)

MW18-031
(11.54)

MW37-030
(11.55)

MW38-035
(11.63)

GRAHAM ROAD

SANDY RIVER

LEGEND

- LOCATION OF SHALLOW MONITORING WELLS SCREENING THE UPPER GRAY SAND
- MW08- WELL IDENTIFICATION NUMBER
- 027 DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
- (10.53) WATER LEVEL ELEVATION MEASURED AUGUST 6,1997
- 12 WATER LEVEL ELEVATION CONTOUR LINE (LOCATION APPROXIMATE)

CONTOUR INTERVAL = 0.5 FOOT
ELEVATIONS ARE IN FEET ABOVE THE 1929 NGVD

CONTOUR INTERVAL CHANGES NEAR BAKEHOUSE TO REFLECT APPARENT LOCALIZED MOUND

N

0 200 600
SCALE IN FEET

Figure 24
AUGUST 1997 WATER LEVEL ELEVATION CONTOUR MAP, SHALLOW MONITORING WELLS SCREENING THE UPPER GRAY SAND
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. GW-12

CH2M HILL

9293WL2E.DWG

SR6 9293WL3E.DWG
02-SEPT-1997

NOTE:
INTERMEDIATE-DEPTH MONITORING WELLS ARE GENERALLY SCREENED IN GRAY UNCONSOLIDATED SAND 80 TO 100 FEET BELOW GROUND SURFACE.

LEGEND
- ● INTERMEDIATE-DEPTH MONITORING WELL LOCATION
- MW08- WELL IDENTIFICATION NUMBER
- 127 DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
- (10.98) WATER LEVEL ELEVATION MEASURED AUGUST 6, 1997
- —11.0— WATER LEVEL ELEVATION CONTOUR LINE (LOCATION APPROXIMATE)
- CONTOUR INTERVAL = 0.25 FOOT
- ELEVATIONS ARE IN FEET ABOVE THE 1929 NGVD

N

0 200 600
SCALE IN FEET

COLUMBIA RIVER
(10.72)
11.0
11.25
MW08-127 (10.98)*
MW30-100 (10.93)
MW27-081 (11.18)
MW21-063 (11.34)
COMPANY LAKE (NM)
OUTFALL ROAD
EAST LAKE
MW31-095 (11.09)
MW39-095 (11.00)
MW06-094 (11.25)
MW29-090 (11.49)
DIKE
BPA SUBSTATION
SANDY RIVER
MW32-095 (11.62)
MW10-090 (11.51)
MW15-086 (11.32)
MW33-095 (11.66)
SUNDIAL ROAD
11.5
MW12-092 (11.37)
MW47-094 (11.66)
11.75
MW03-098 (11.76)
GRAHAM ROAD

*TO TARGET AN INTERVAL SUSPECTED OF BEING CONTAMINATED, MW08-127 WAS SCREENED APPROXIMATELY 50 FEET DEEPER THAN NEARBY INTERMEDIATE-DEPTH WELLS. THEREFORE, WATER LEVEL ELEVATIONS AND CONCENTRATIONS AT THIS LOCATION MAY NOT BE COMPARABLE WITH THOSE AT NEARBY LOCATIONS.

Figure 25
AUGUST 1997 WATER LEVEL ELEVATION CONTOUR MAP, INTERMEDIATE-DEPTH MONITORING WELLS
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. CW-12

CH2MHILL

9293WL3E.DWG

SRB 9293WL4E.DWG
16-OCT-1997

NOTE:
DEEP MONITORING WELLS ARE SCREENED 150 TO 180 FEET BELOW GROUND SURFACE. SCREENED MATERIALS ARE PRIMARILY GRAY SAND TO THE SOUTH, SAND AND GRAVEL TO THE NORTH.

LEGEND
- ● DEEP MONITORING WELL LOCATION
- MW08- WELL IDENTIFICATION NUMBER
- 169 DEPTH TO BOTTOM OF WELL SCREEN (FEET BELOW GROUND SURFACE)
- (10.59) WATER LEVEL ELEVATION MEASURED AUGUST 6, 1997
- 11.25 WATER LEVEL ELEVATION CONTOUR LINE (LOCATION APPROXIMATE)
- ▲ PW10 RMC PRODUCTION WELL
- CONTOUR INTERVAL = 0.25 FOOT
- ELEVATIONS ARE IN FEET ABOVE THE 1929 NGVD

N

0 200 600
SCALE IN FEET

(10.72) COLUMBIA RIVER

MW08-169 (10.59)
MW27-176 (11.29)
MW21-176 (10.58)
MW06-176 (11.29)
MW29-179 (11.40)
MW15-175 (11.32)
MW32-165 (11.64)
MW33-165 (10.93)
MW10-165 (11.41)
MW28-160 (11.64)
MW12-184 (11.36)
MW03-175 (11.78)
PW03
PW08
PW07
PW04
PW18

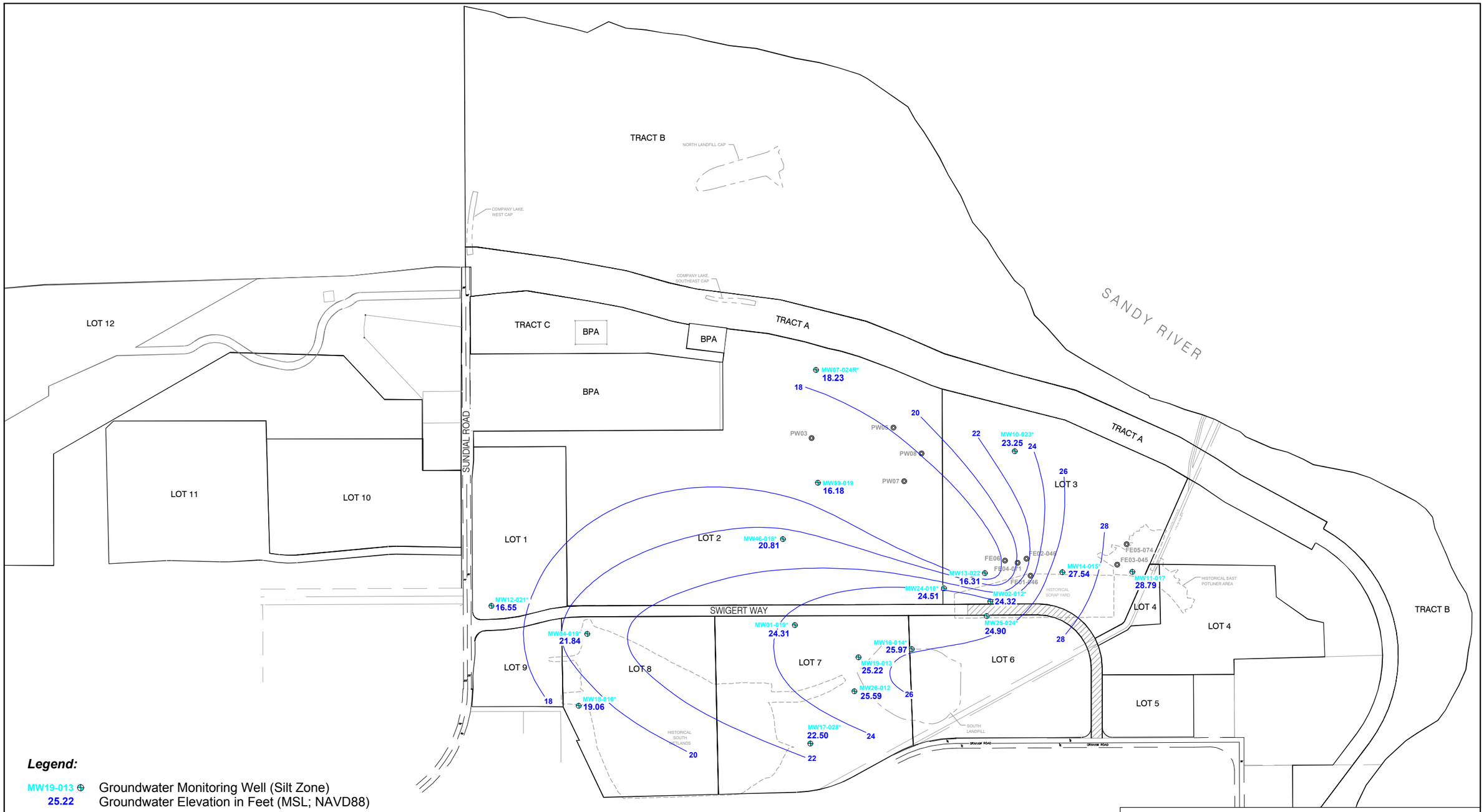
10.75
11.0
11.25
11.5
11.75

COMPANY LAKE (NM)
OUTFALL ROAD
EAST LAKE
DIKE
BPA SUBSTATION
SUNDIAL ROAD
GRAHAM ROAD
SANDY RIVER

Figure 26
AUGUST 1997 WATER LEVEL ELEVATION CONTOUR MAP, DEEP MONITORING WELLS
REYNOLDS METALS COMPANY
TROUTDALE, OREGON
Technical Memorandum No. GW-12

CH2MHILL

9293WL4E.DWG



Legend:

MW19-013 ⊕ / 25.22 — Groundwater Monitoring Well (Silt Zone) / Groundwater Elevation in Feet (MSL; NAVD88)

20 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

FE01 ⊙ — Focused Extraction Well

PW03 ⊙ — Production Well

NOTES:

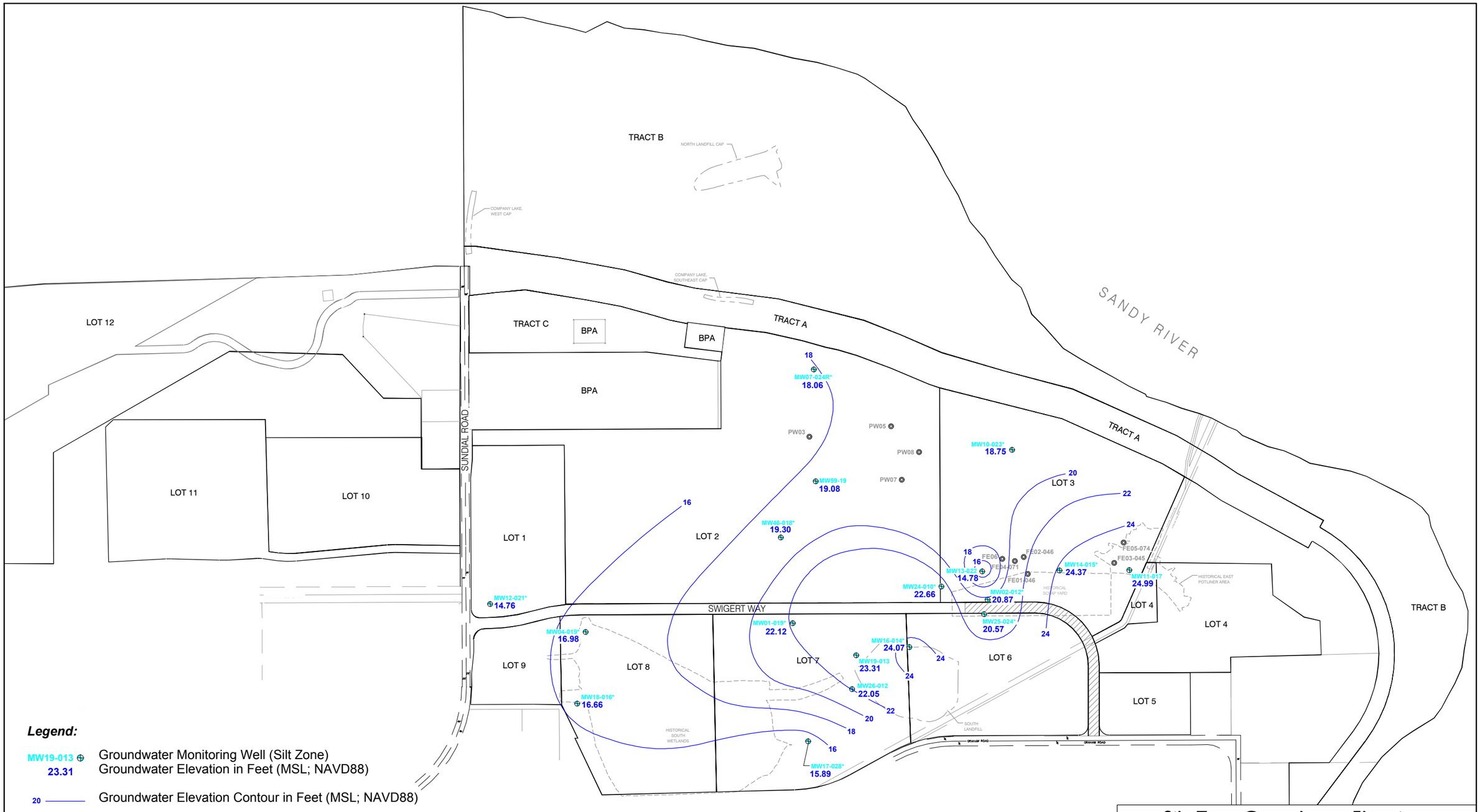
1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) Contour interval of 2 feet.

Silt Zone Groundwater Elevations February 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		4



Legend:

MW19-013 ⊕ 23.31	Groundwater Monitoring Well (Silt Zone) Groundwater Elevation in Feet (MSL; NAVD88)
20	Groundwater Elevation Contour in Feet (MSL; NAVD88)
NA	Not Available
FE01 ◎	Focused Extraction Well
PW03 ◎	Production Well

NOTES:

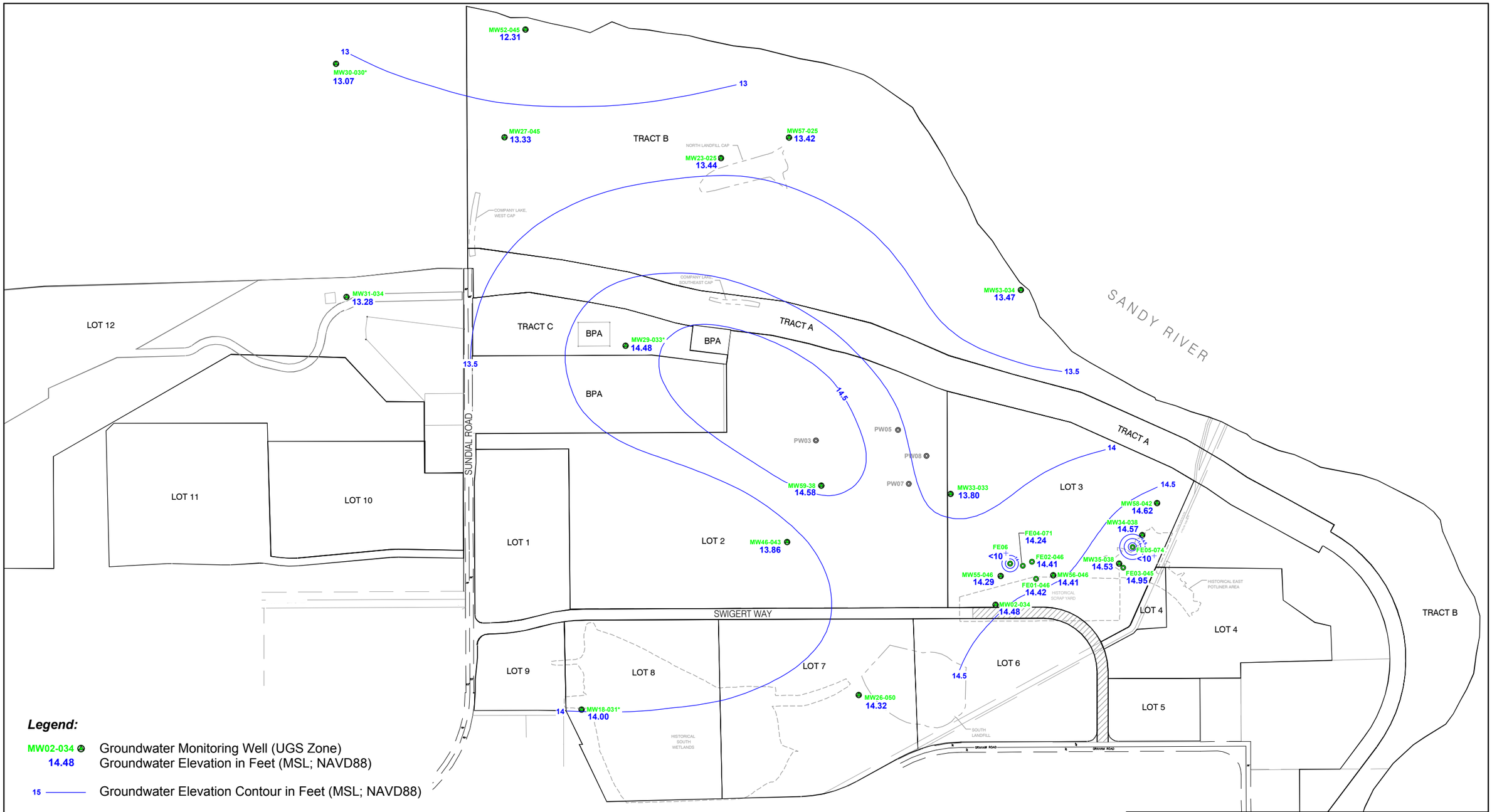
1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) Contour interval of 2 feet.

Silt Zone Groundwater Elevations August 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		5



Legend:

MW02-034 / 14.48 — Groundwater Monitoring Well (UGS Zone); Groundwater Elevation in Feet (MSL; NAVD88)

15 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

NA — Not Available

FE01 — Focused Extraction Well

PW03 — Production Well

NOTES:

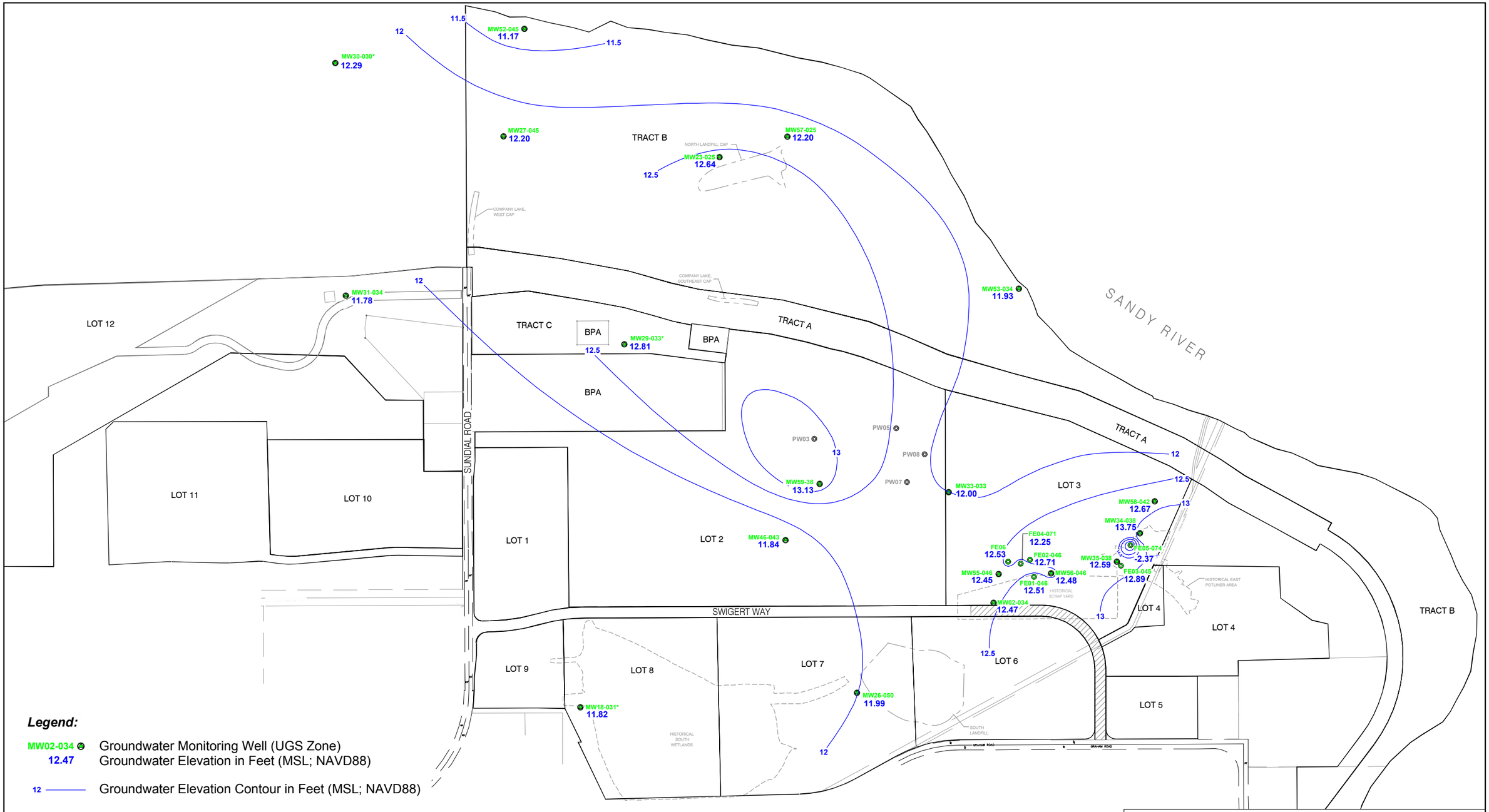
1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) +Indicates operating pumping well.
4) Contour interval of 0.5 foot.

Upper Gray Sand Zone Groundwater Elevations February 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		6



Legend:

MW02-034 / 12.47	Groundwater Monitoring Well (UGS Zone) / Groundwater Elevation in Feet (MSL; NAVD88)
12	Groundwater Elevation Contour in Feet (MSL; NAVD88)
NA	Not Available
FE01	Focused Extraction Well
PW03	Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) $^{+}$Indicates operating pumping well.
4) Contour interval of 0.5 foot.

N

0 600 1,200

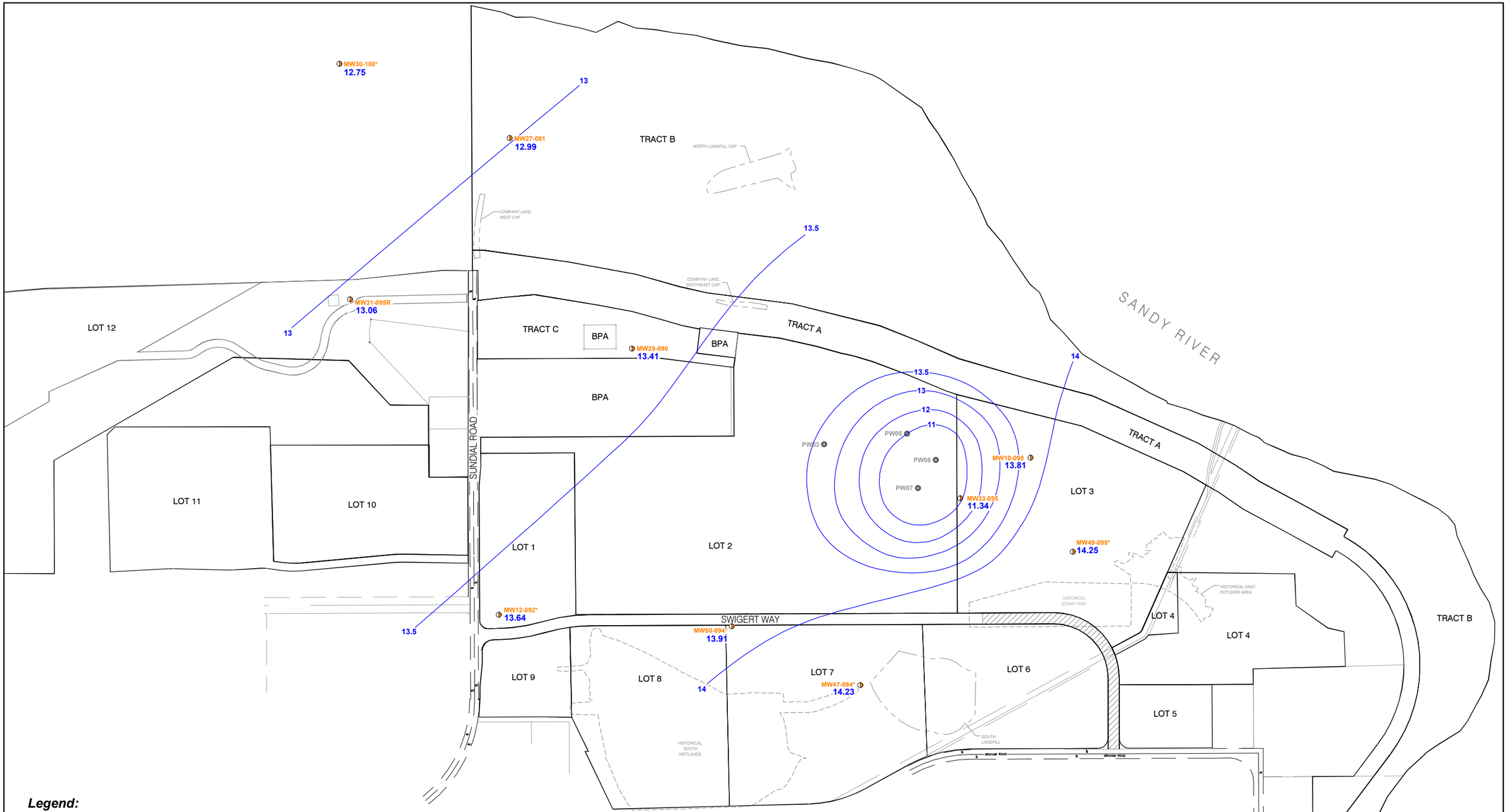
Scale in Feet

Upper Gray Sand Zone Groundwater Elevations August 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		7



Legend:

MW33-095 / 11.34 — Groundwater Monitoring Well (Intermediate Zone); Groundwater Elevation in Feet (MSL; NAVD88)

14 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) Contour interval of 0.5 foot.

N

0 600 1,200

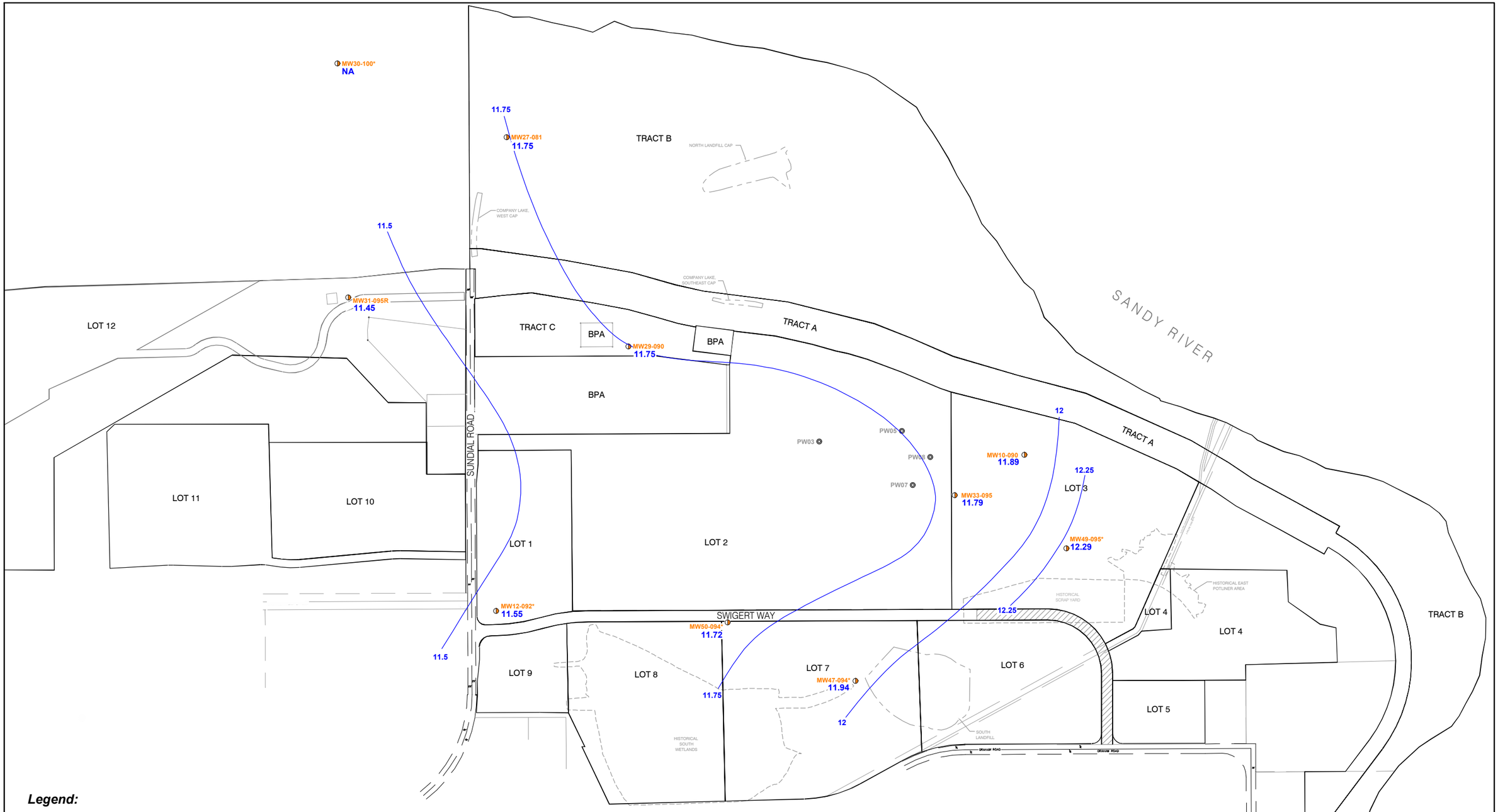
Scale in Feet

Intermediate Zone Groundwater Elevations February 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		8



Legend:

MW33-095 / 11.79 — Groundwater Monitoring Well (Intermediate Zone); Groundwater Elevation in Feet (MSL; NAVD88)

11.5 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) Contour interval of 0.25 foot.

N

0 600 1,200

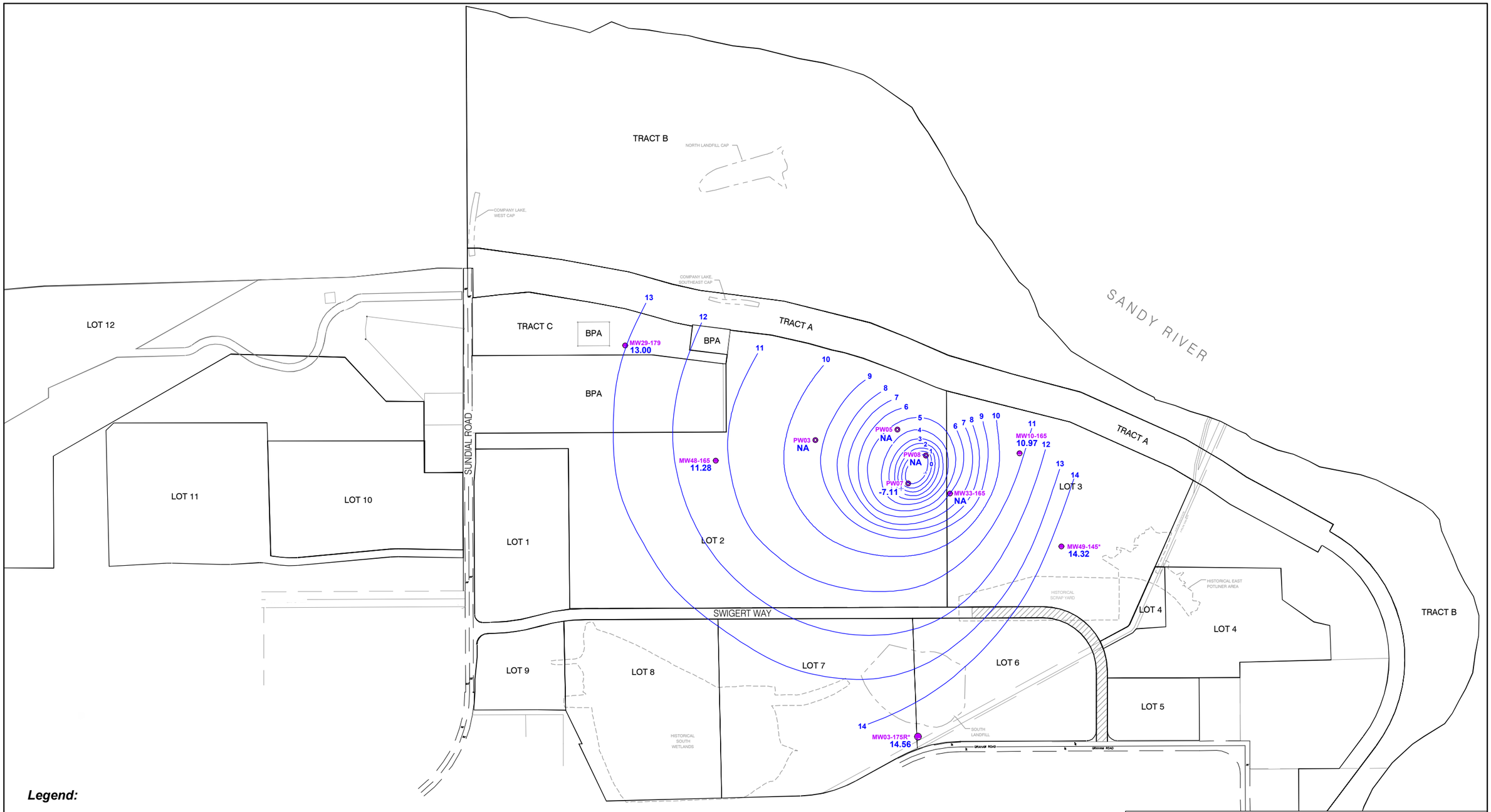
Scale in Feet

Intermediate Zone Groundwater Elevations August 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		9



Legend:

MW48-165 — Groundwater Monitoring Well (Deep Zone)
11.28 — Groundwater Elevation in Feet (MSL; NAVD88)

13 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) $^{+}$Indicates operating pumping well.
4) Contour interval of 1 foot.

N

0 600 1,200

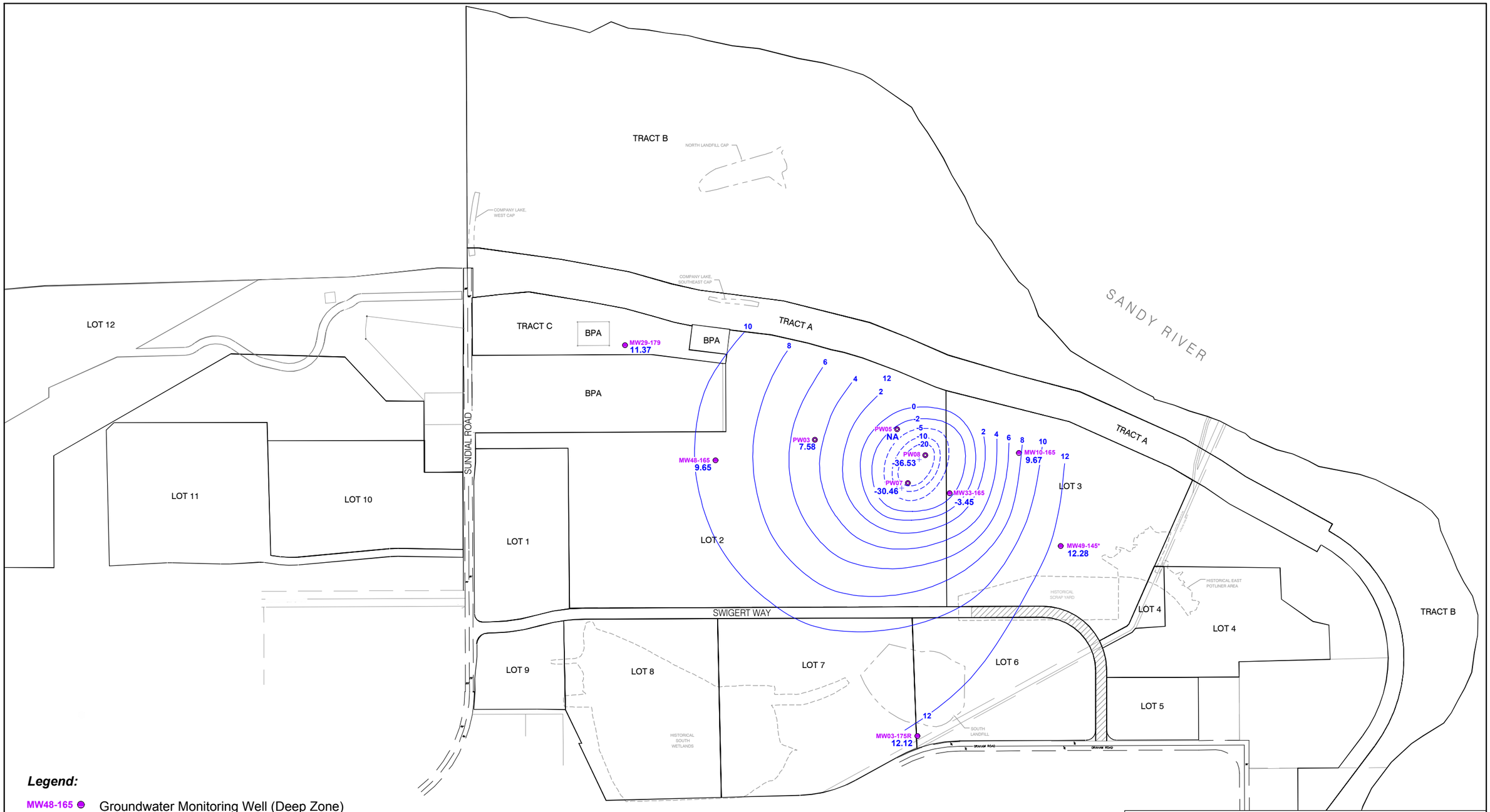
Scale in Feet

Deep Zone Groundwater Elevations February 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		10



Legend:

MW48-165 ● Groundwater Monitoring Well (Deep Zone)
9.65 Groundwater Elevation in Feet (MSL; NAVD88)

11 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 ⊙ Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) *Indicates water level only.
3) $^{+}$Indicates operating pumping well.
4) Contour interval of 2 foot.
5) Dashed contours represent contour interval outside of normal (2-foot) interval-included for additional clarity in selected areas.

N

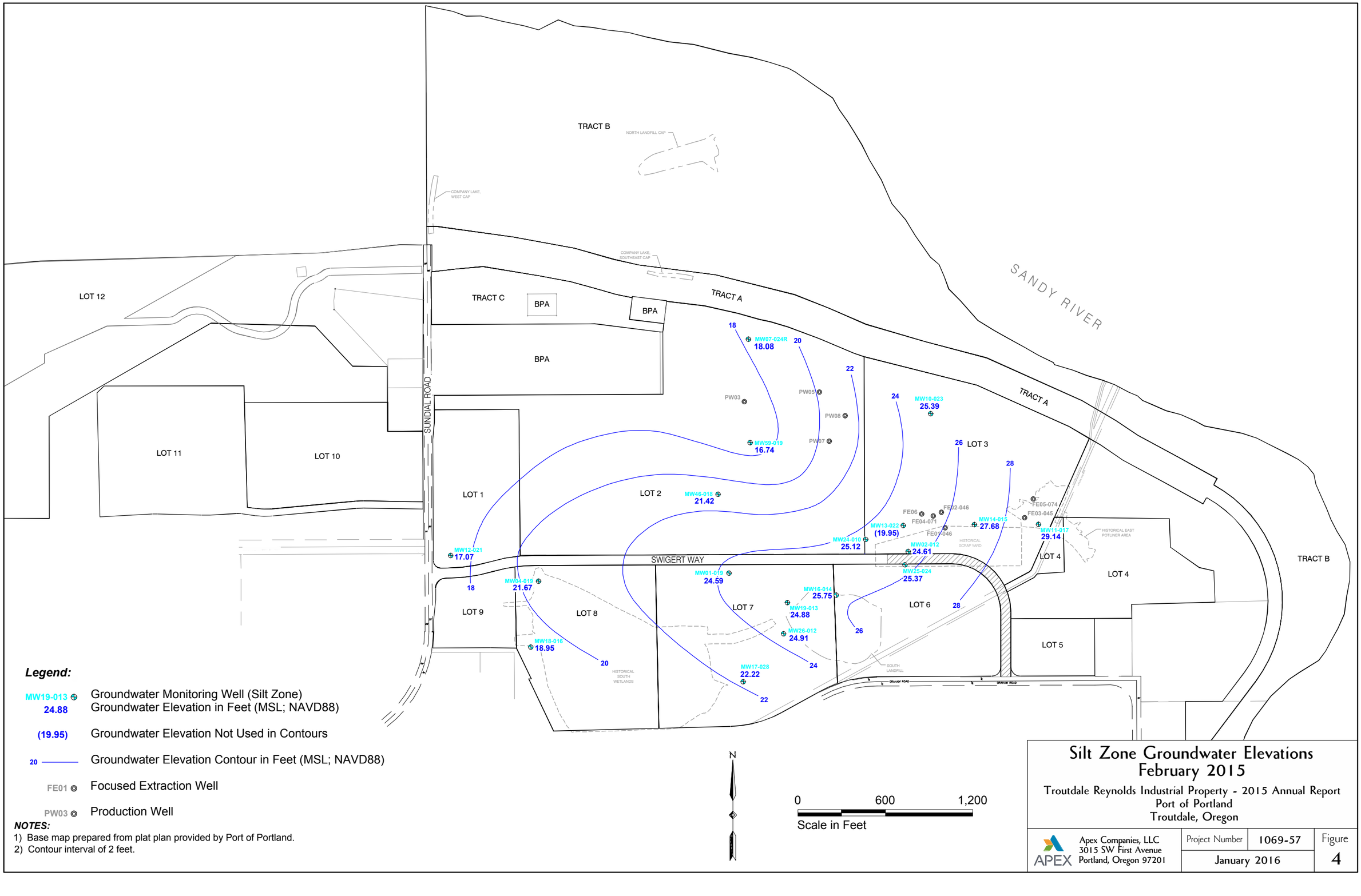
0 600 1,200
Scale in Feet

Deep Zone Groundwater Elevations August 2014

Troutdale Reynolds Industrial Property - 2014 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-49	Figure
January 2015		11



Legend:

MW19-013 ⊕ 24.88	Groundwater Monitoring Well (Silt Zone) Groundwater Elevation in Feet (MSL; NAVD88)
(19.95)	Groundwater Elevation Not Used in Contours
20 ———	Groundwater Elevation Contour in Feet (MSL; NAVD88)
FE01 ◎	Focused Extraction Well
PW03 ◎	Production Well

NOTES:

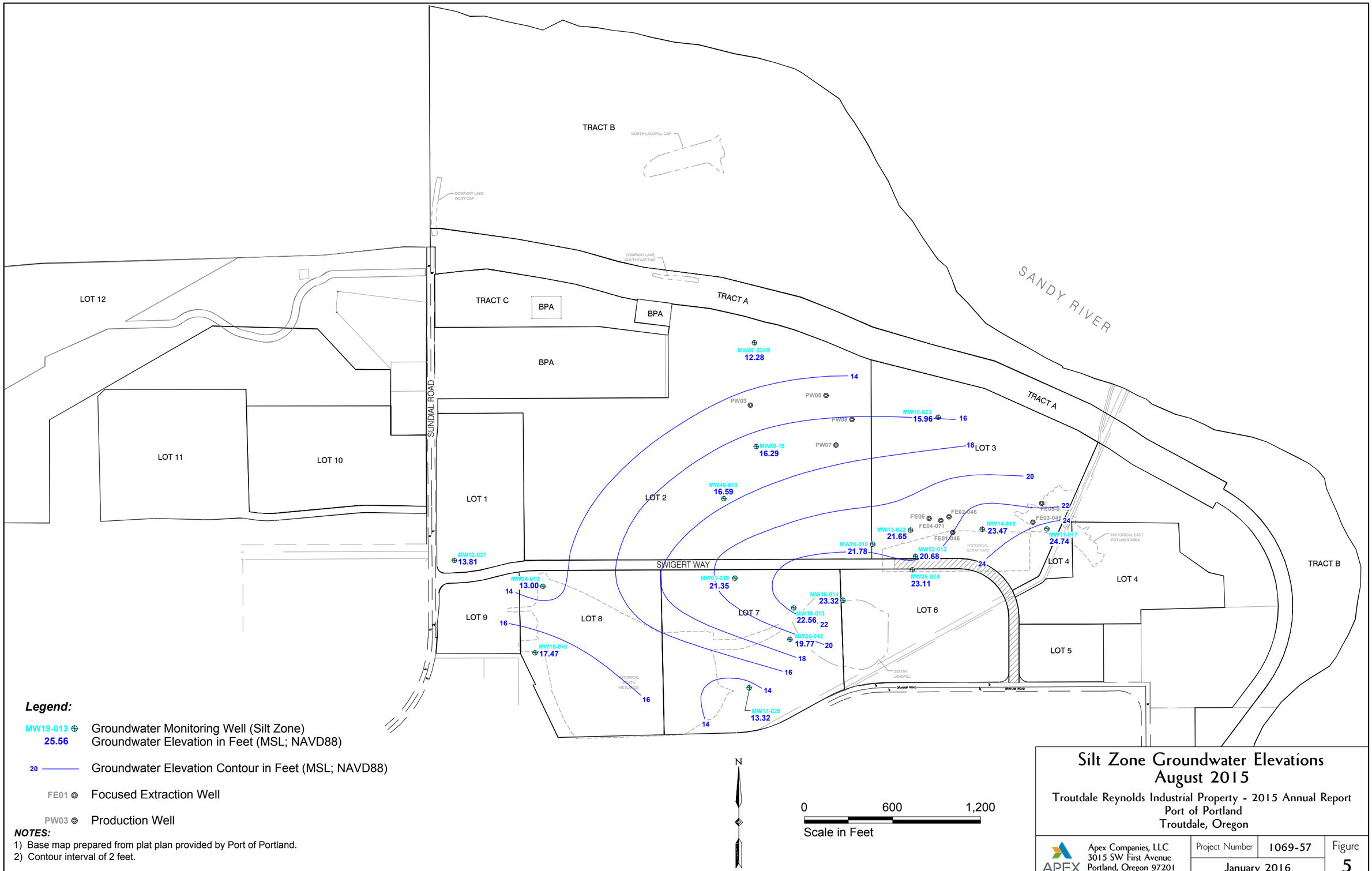
1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 2 feet.

Silt Zone Groundwater Elevations February 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		4



Legend:

MW19-013 ⊕ Groundwater Monitoring Well (Silt Zone)
25.56 Groundwater Elevation in Feet (MSL; NAVD88)

20 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

FE01 ◎ Focused Extraction Well

PW03 ◎ Production Well

NOTES:

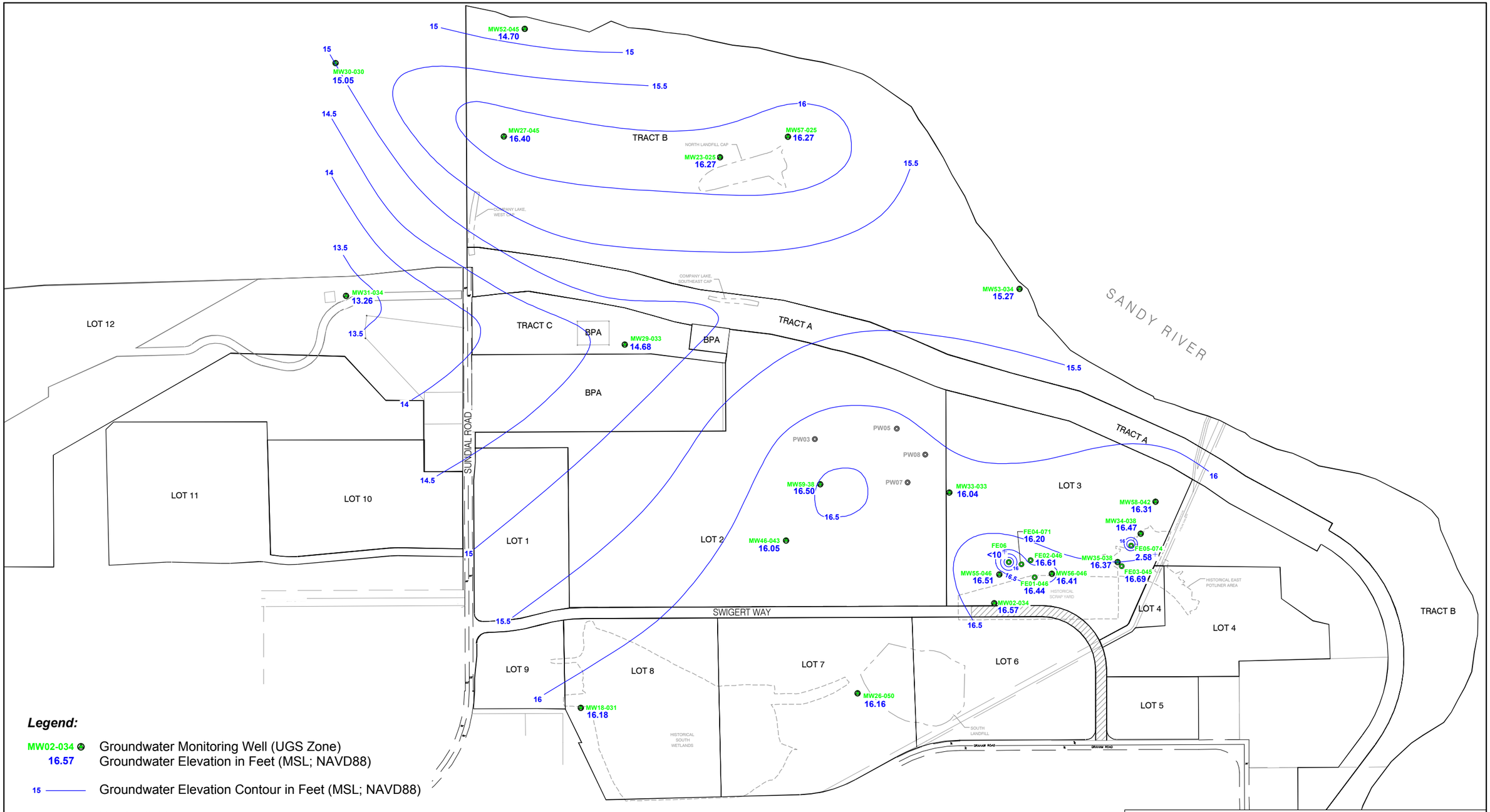
1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 2 feet.

Silt Zone Groundwater Elevations August 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		5



Legend:

MW02-034 ◎	Groundwater Monitoring Well (UGS Zone)
16.57	Groundwater Elevation in Feet (MSL; NAVD88)
15 ———	Groundwater Elevation Contour in Feet (MSL; NAVD88)
NA	Not Available
FE01 ◎	Focused Extraction Well
PW03 ◎	Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) + Indicates operating pumping well.
3) Contour interval of 0.5 foot.

N

0 600 1,200

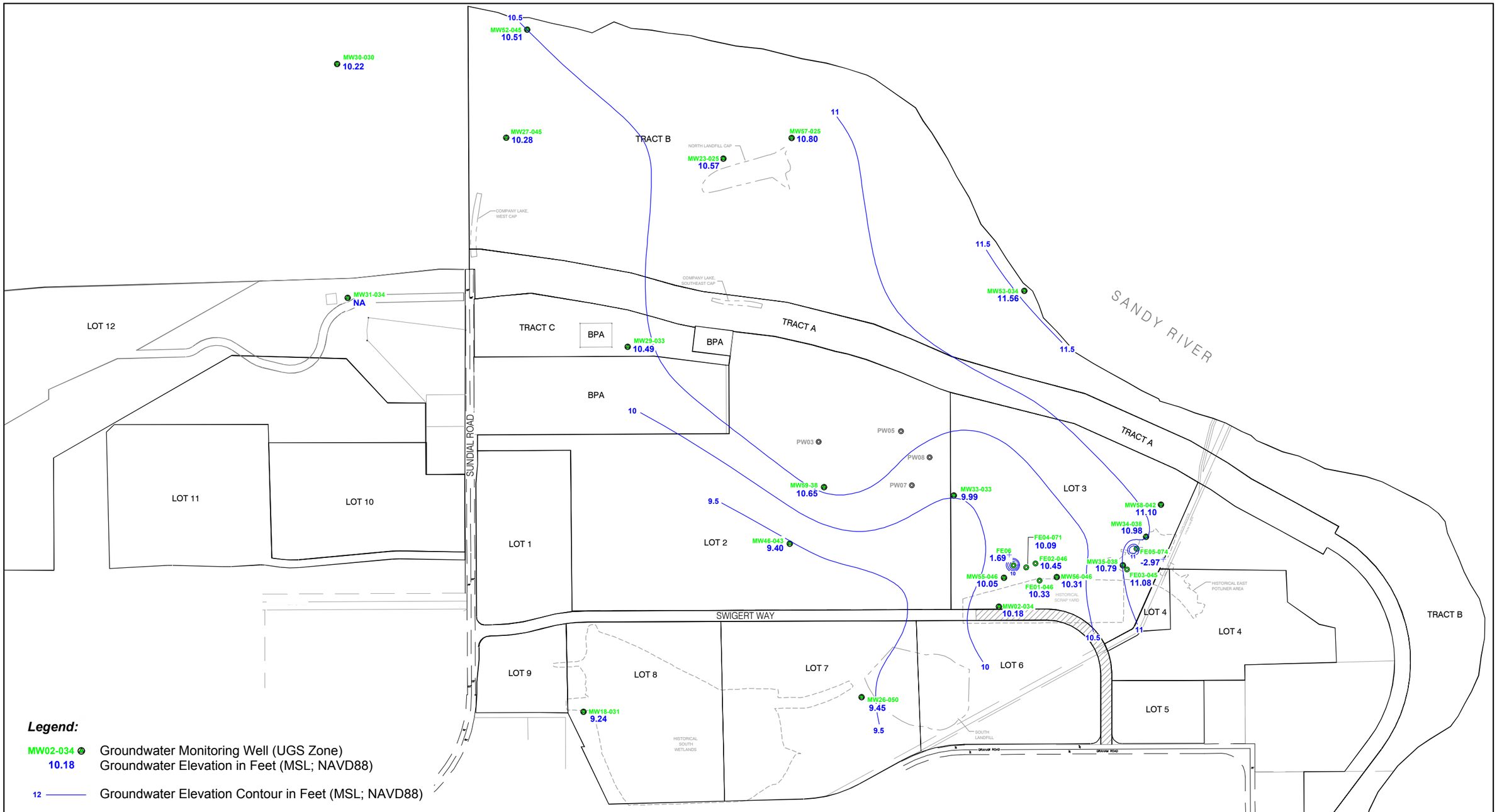
Scale in Feet

Upper Gray Sand Zone Groundwater Elevations February 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		6



Legend:

- MW02-034 / 10.18 — Groundwater Monitoring Well (UGS Zone); Groundwater Elevation in Feet (MSL; NAVD88)
- 12 — Groundwater Elevation Contour in Feet (MSL; NAVD88)
- NA — Not Available
- FE01 — Focused Extraction Well
- PW03 — Production Well

NOTES:

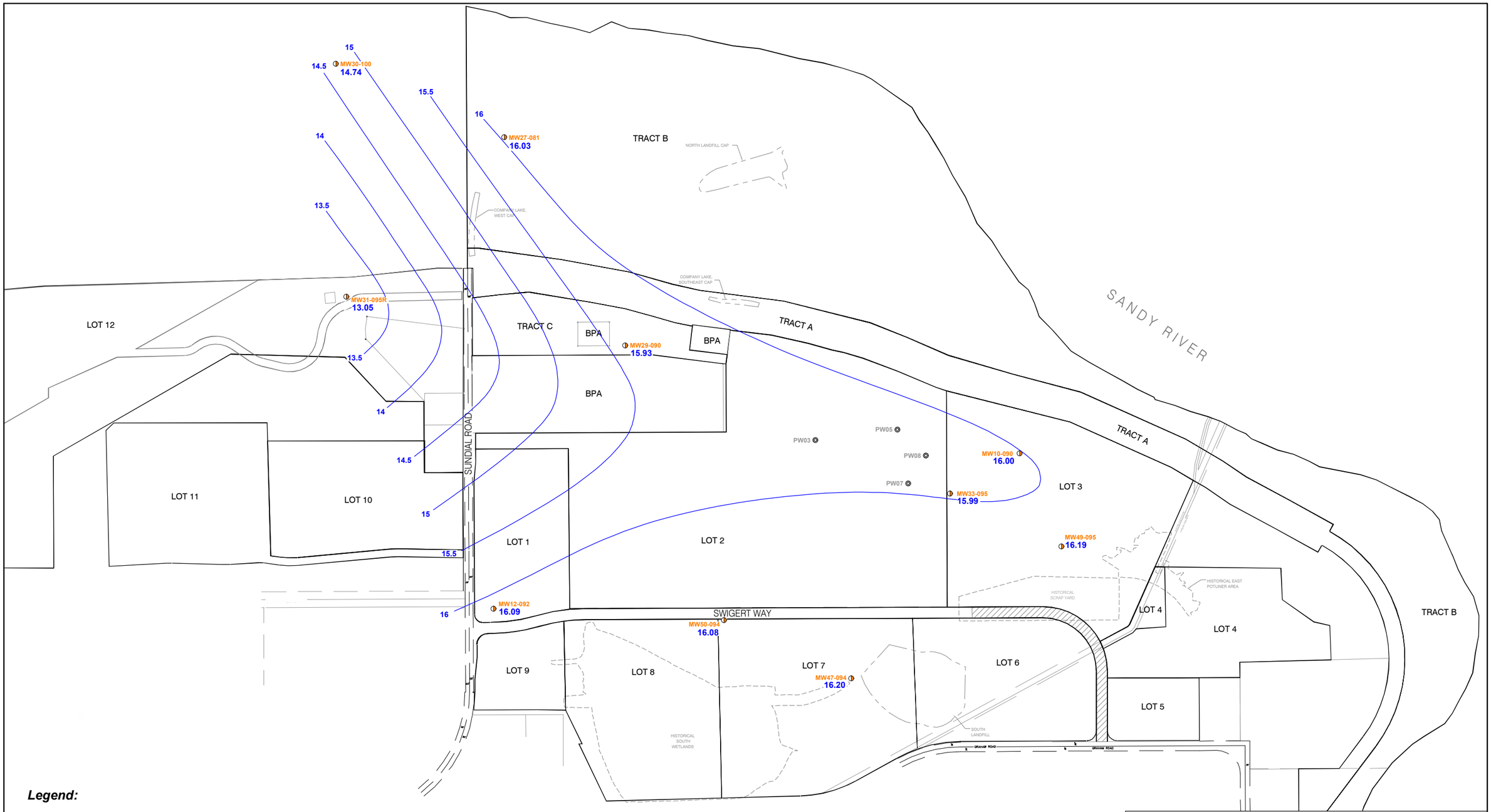
1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 0.5 foot.

Upper Gray Sand Zone Groundwater Elevations August 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		7



Legend:

MW33-095 / 15.99 — Groundwater Monitoring Well (Intermediate Zone); Groundwater Elevation in Feet (MSL; NAVD88)

14 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 0.5 foot.

N

0 600 1,200

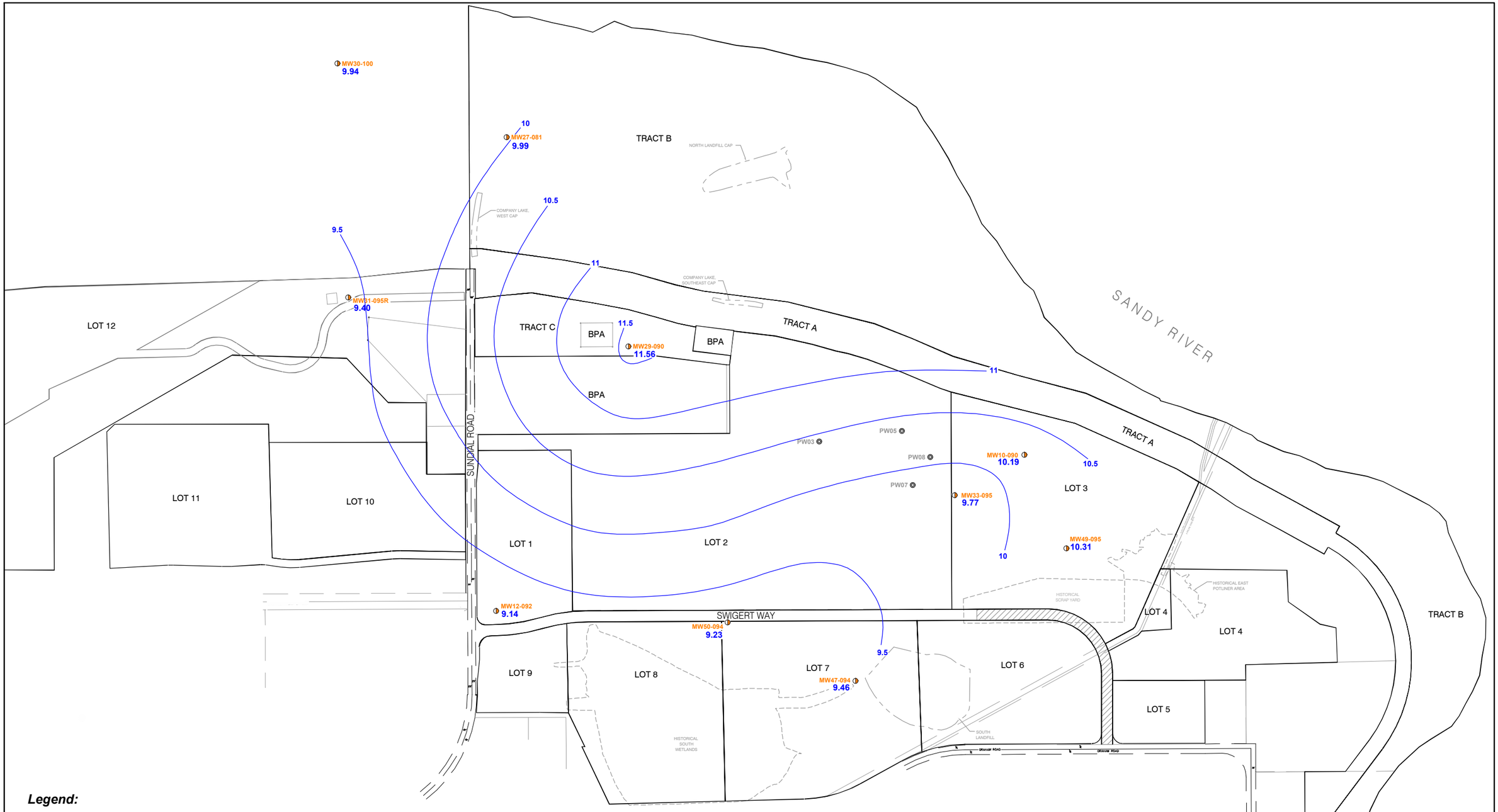
Scale in Feet

Intermediate Zone Groundwater Elevations February 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		8



Legend:

MW33-095 / 9.77 — Groundwater Monitoring Well (Intermediate Zone); Groundwater Elevation in Feet (MSL; NAVD88)

11.5 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 0.5 foot.

N

0 600 1,200

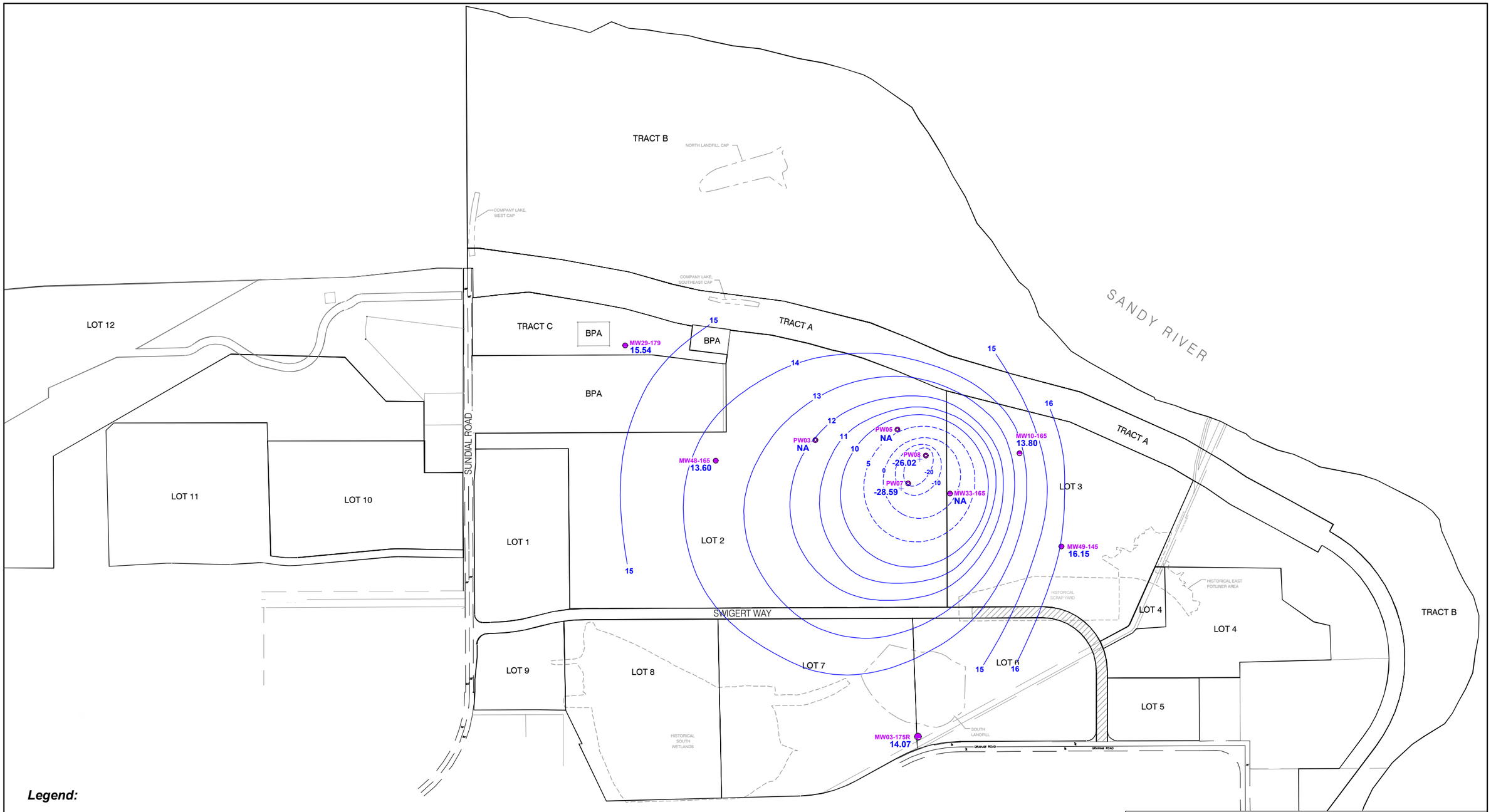
Scale in Feet

Intermediate Zone Groundwater Elevations August 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		9



Legend:

MW48-165 — Groundwater Monitoring Well (Deep Zone)
13.60 — Groundwater Elevation in Feet (MSL; NAVD88)

13 — Groundwater Elevation Contour in Feet - Dashed Where Inferred (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 1 foot.

N

0 600 1,200

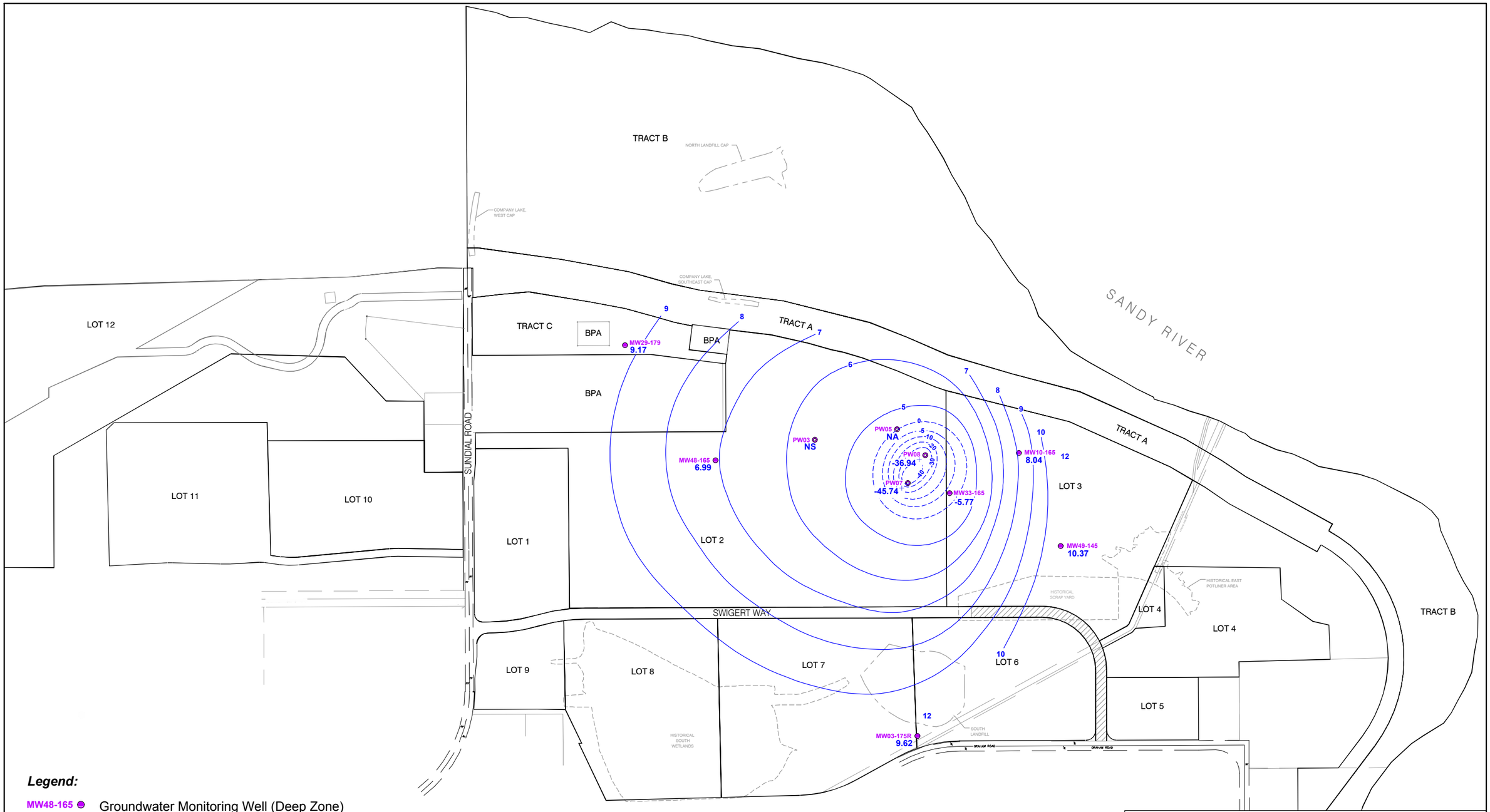
Scale in Feet

Deep Zone Groundwater Elevations February 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		10



Legend:

MW48-165 ● Groundwater Monitoring Well (Deep Zone)
6.99 Groundwater Elevation in Feet (MSL; NAVD88)

11 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 ⊙ Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 2 foot.
4) Dashed contours represent contour interval outside of normal (2-foot) interval-included for additional clarity in selected areas.

N

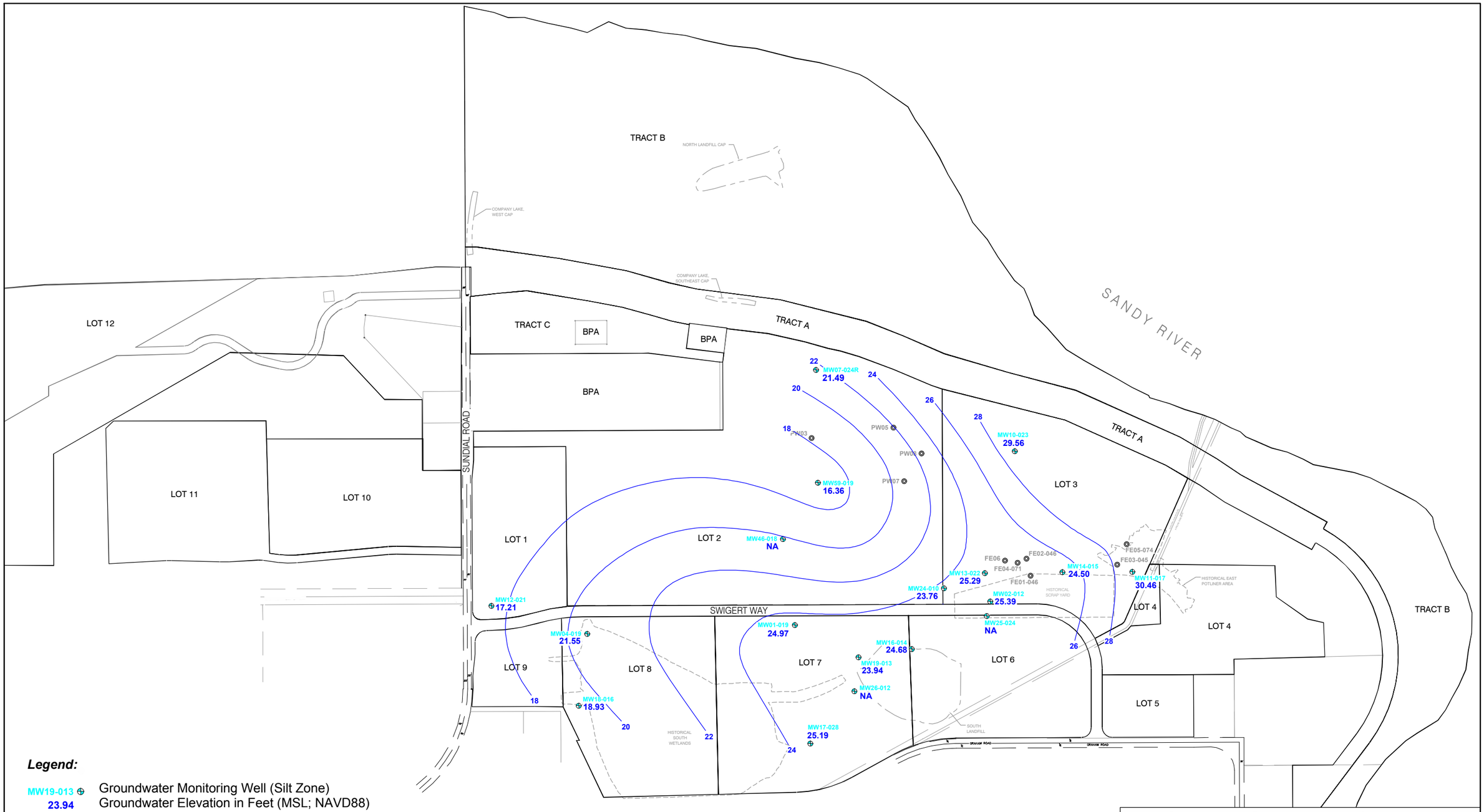
0 600 1,200
Scale in Feet

Deep Zone Groundwater Elevations August 2015

Troutdale Reynolds Industrial Property - 2015 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-57	Figure
January 2016		11



Legend:

MW19-013 ⊕ 23.94 — Groundwater Monitoring Well (Silt Zone) Groundwater Elevation in Feet (MSL; NAVD88)

20 ——— Groundwater Elevation Contour in Feet (MSL; NAVD88)

FE01 ◎ — Focused Extraction Well

PW03 ◎ — Production Well

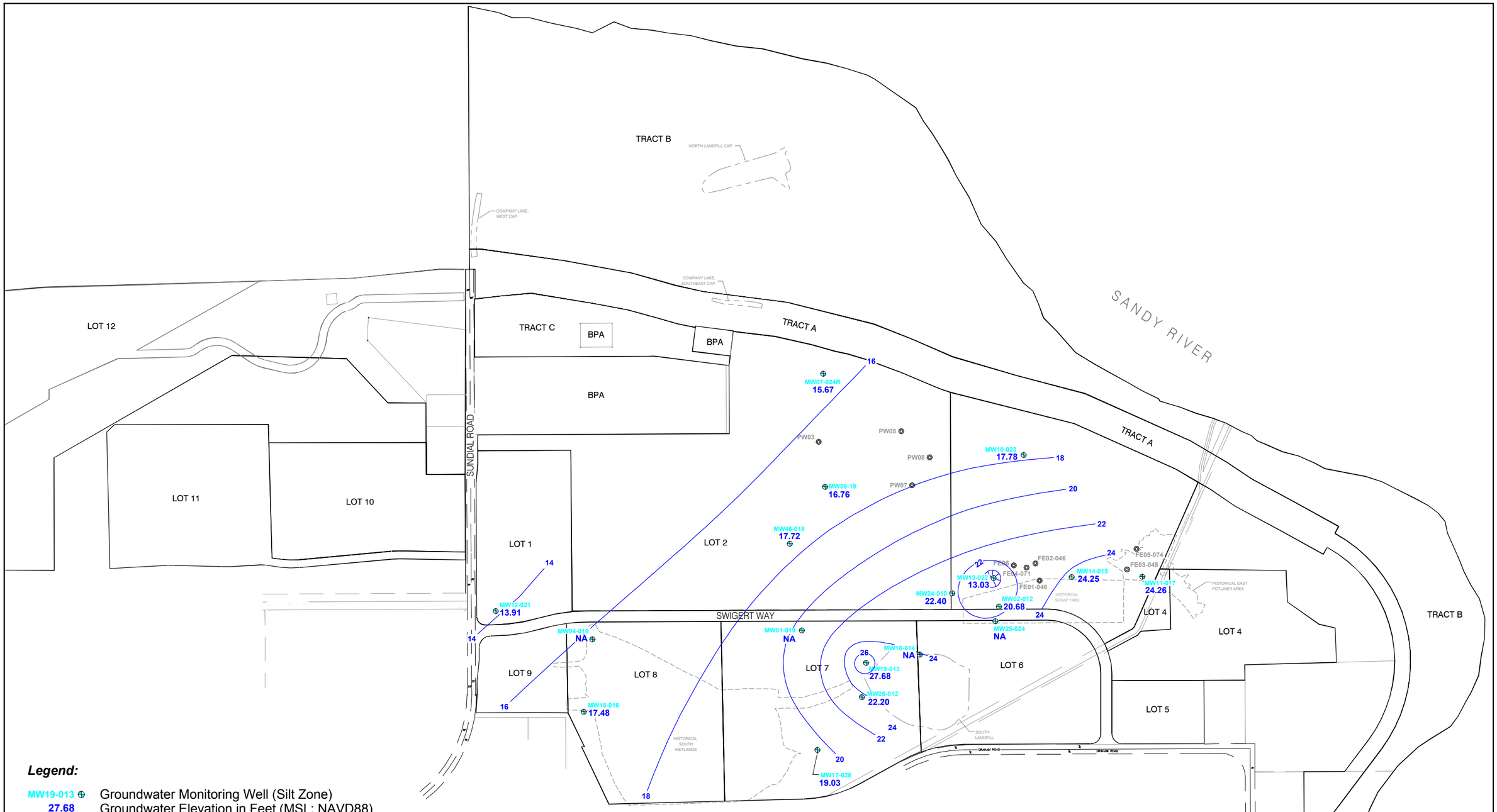
NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 2 feet.

Silt Zone Groundwater Elevations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC 3015 SW First Avenue Portland, Oregon 97201	Project Number	1069-70	Figure 4
	January 2017		



Legend:

MW19-013 ⊕ Groundwater Monitoring Well (Silt Zone)
27.68 Groundwater Elevation in Feet (MSL; NAVD88)

20 —— Groundwater Elevation Contour in Feet (MSL; NAVD88)

FE01 ◎ Focused Extraction Well

PW03 ◎ Production Well

NOTES:

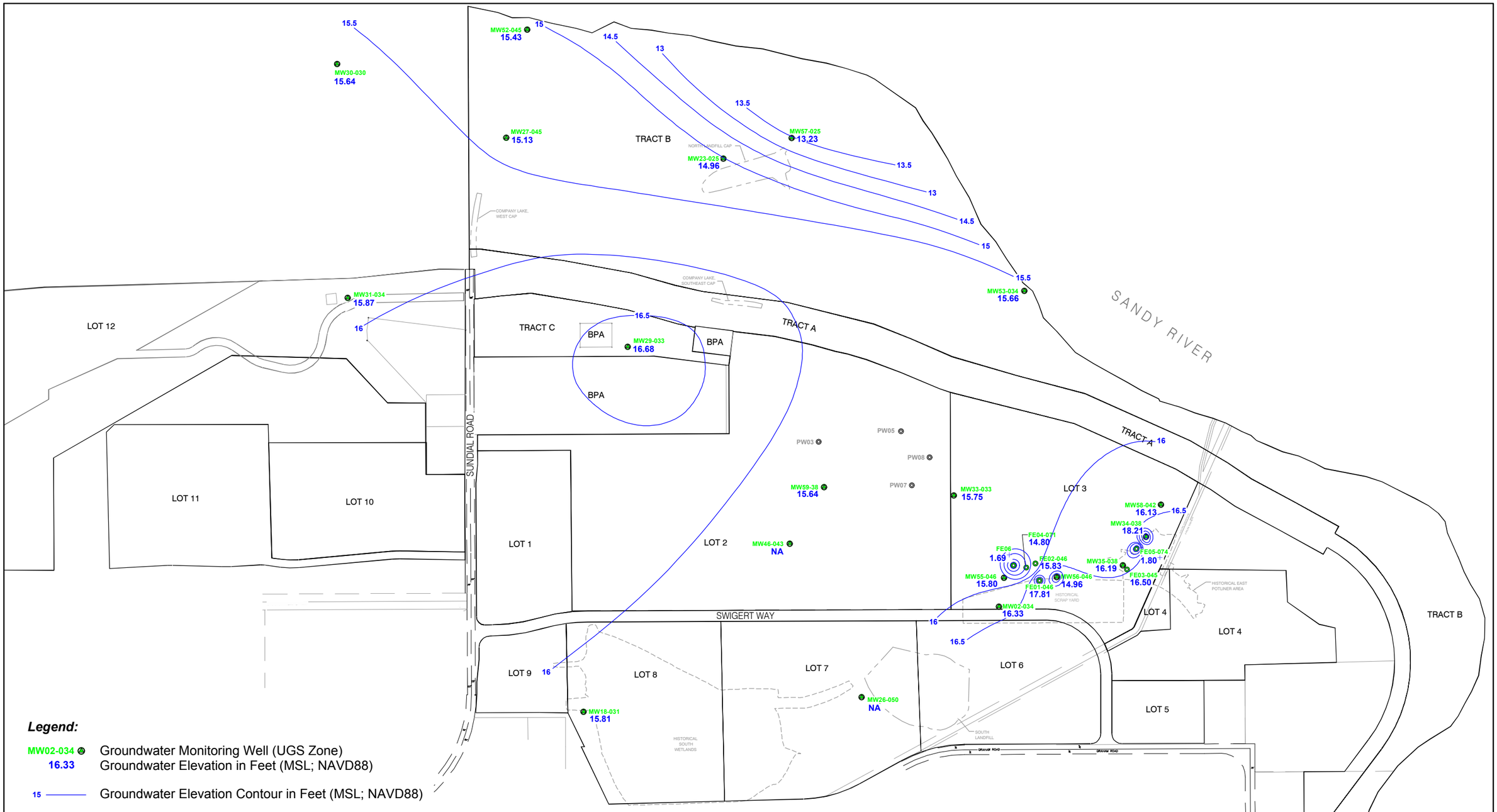
1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 2 feet.

Silt Zone Groundwater Elevations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		5



Legend:

MW02-034 / 16.33	Groundwater Monitoring Well (UGS Zone) / Groundwater Elevation in Feet (MSL; NAVD88)
15	Groundwater Elevation Contour in Feet (MSL; NAVD88)
NA	Not Available
FE01	Focused Extraction Well
PW03	Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 0.5 foot.

N

0 600 1,200

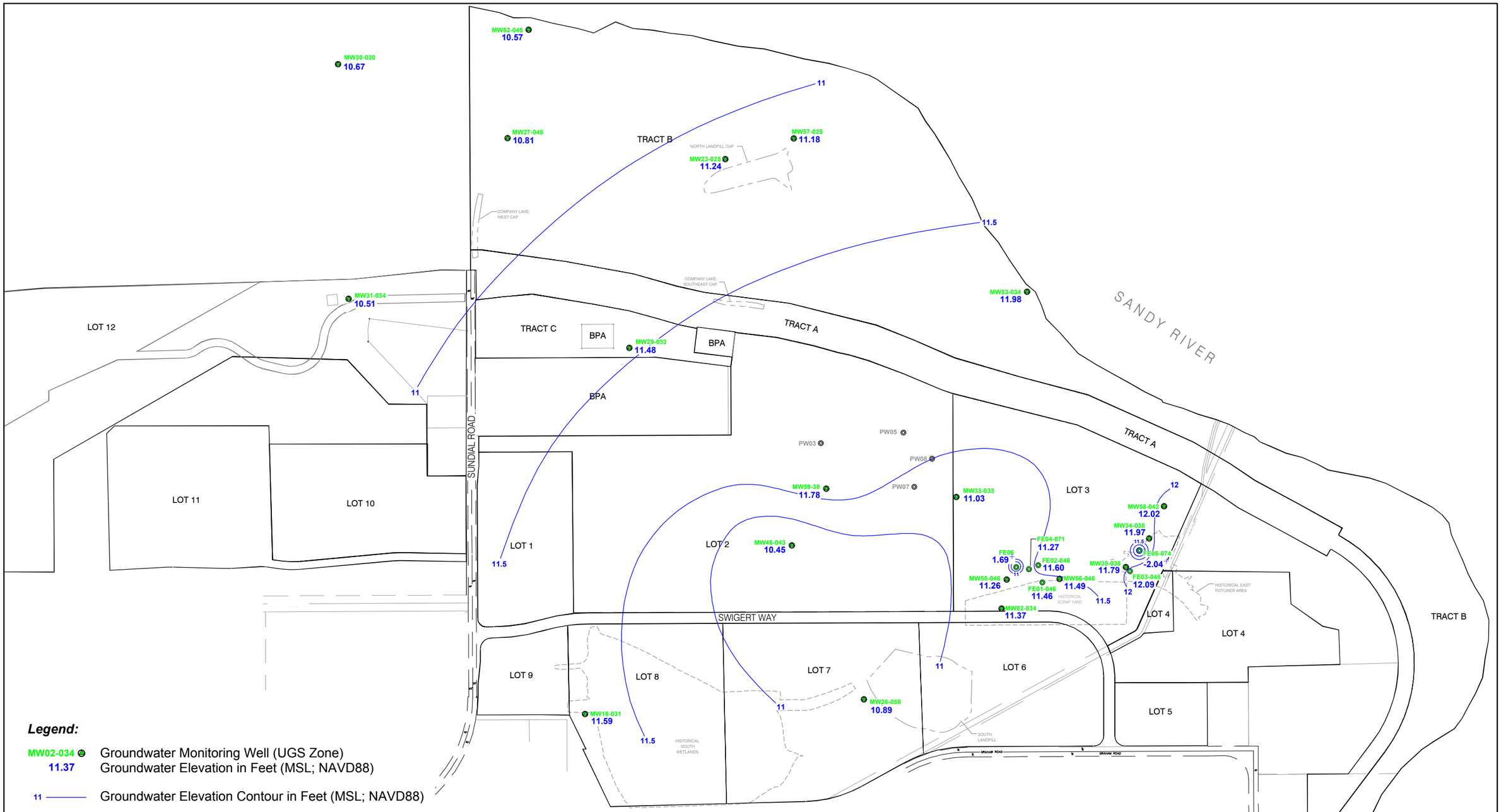
Scale in Feet

Upper Gray Sand Zone Groundwater Elevations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		6



Legend:

MW02-034 / 11.37	Groundwater Monitoring Well (UGS Zone) / Groundwater Elevation in Feet (MSL; NAVD88)
11	Groundwater Elevation Contour in Feet (MSL; NAVD88)
NA	Not Available
FE01	Focused Extraction Well
PW03	Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 0.5 foot.

N

0 600 1,200

Scale in Feet

Upper Gray Sand Zone Groundwater Elevations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		7

MW30-100
21.92

MW27-081
20.02

MW31-095R
13.11

MW29-090
18.70

MW12-092
10.40

MW50-094
14.85

MW47-094
17.30

MW10-090
18.89

MW33-095
18.48

MW49-095
18.01

21 20 19 18 17 16 15 14 13 12 11

TRACT B

TRACT C

TRACT A

BPA

LOT 12

LOT 11

LOT 10

LOT 1

LOT 2

LOT 3

LOT 4

LOT 5

LOT 6

LOT 7

LOT 8

LOT 9

SUNDIAL ROAD

SWIGERT WAY

GRAHAM ROAD

SANDY RIVER

NORTH LANDFILL CAP

COMPANY LAKE, WEST CAP

COMPANY LAKE, SOUTHEAST CAP

HISTORICAL SCRAP YARD

HISTORICAL EAST POTLINER AREA

HISTORICAL SOUTH WETLANDS

SOUTH LANDFILL

PW03

PW05

PW07

PW08

Legend:

MW33-095 / 18.48 — Groundwater Monitoring Well (Intermediate Zone) / Groundwater Elevation in Feet (MSL; NAVD88)

14 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 1 foot.

N

0 600 1,200

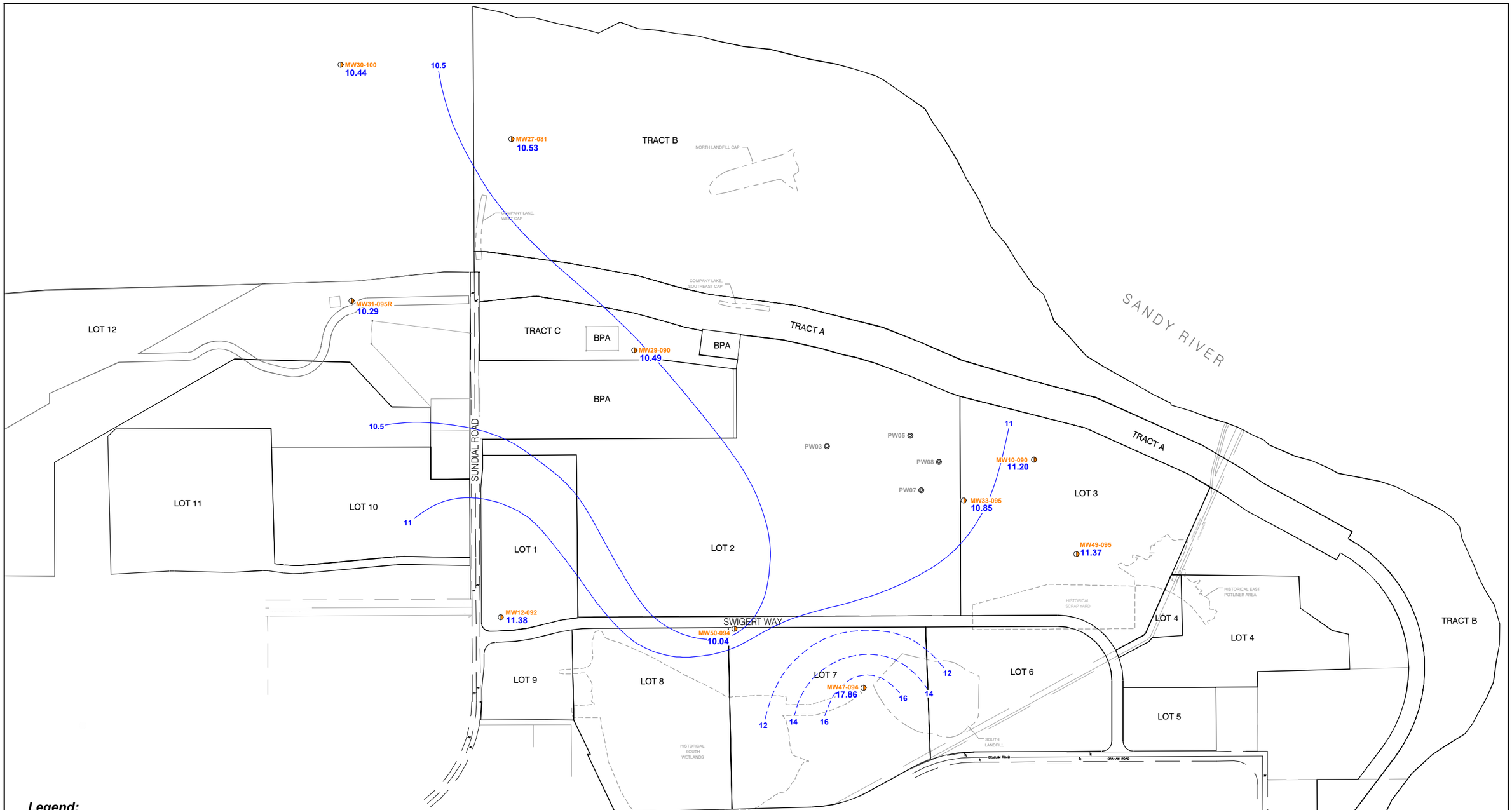
Scale in Feet

Intermediate Zone Groundwater Elevations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

APEX
Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		8



Legend:

MW33-095 / 10.87 — Groundwater Monitoring Well (Intermediate Zone) / Groundwater Elevation in Feet (MSL; NAVD88)

11 — Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 — Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) Contour interval of 0.5 foot.
3) Dashed contours represent contour interval outside of normal (0.5') interval; included for additional clarity in selected areas.

N

0 600 1,200

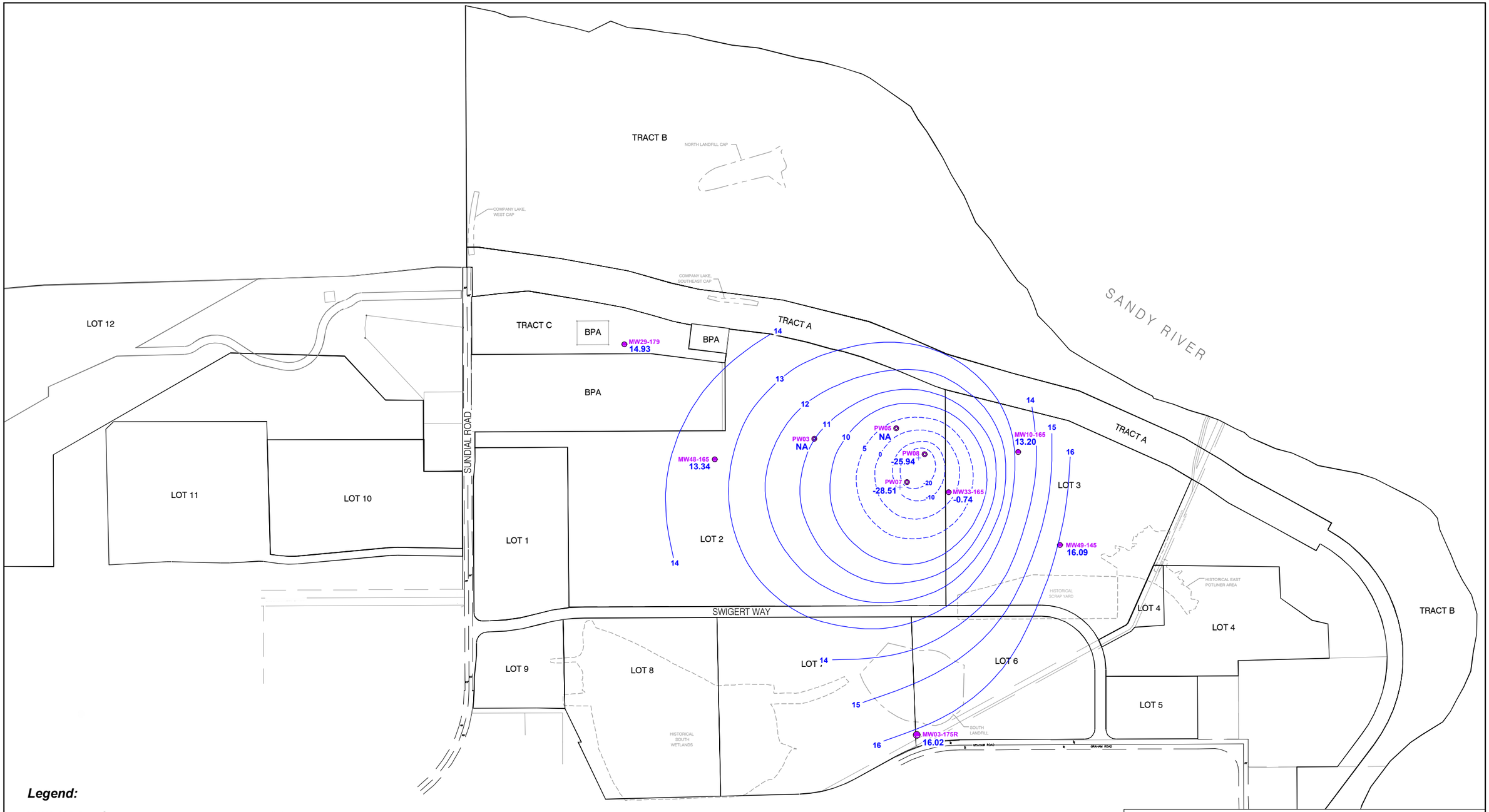
Scale in Feet

Intermediate Zone Groundwater Elevations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		9



Legend:

MW48-165 ● Groundwater Monitoring Well (Deep Zone)
13.34 Groundwater Elevation in Feet (MSL; NAVD88)

14 ——— Groundwater Elevation Contour in Feet - Dashed Where Inferred (MSL; NAVD88)

PW03 ◎ Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 1 foot.

N

0 600 1,200

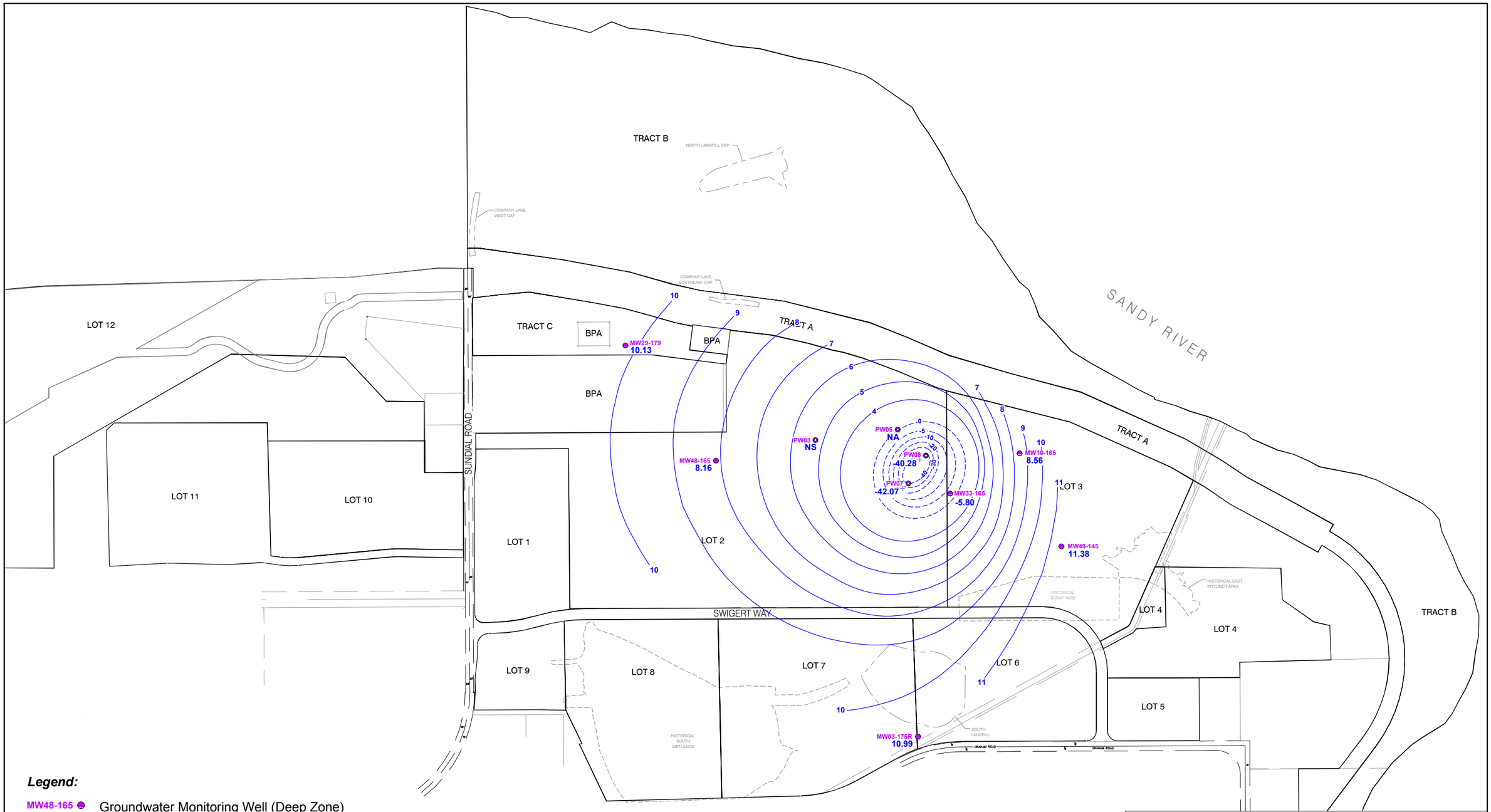
Scale in Feet

Deep Zone Groundwater Elevations February 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		10



Legend:

MW48-165 ● Groundwater Monitoring Well (Deep Zone)
8.16 Groundwater Elevation in Feet (MSL; NAVD88)

8 —— Groundwater Elevation Contour in Feet (MSL; NAVD88)

PW03 ⊗ Production Well

NOTES:

1) Base map prepared from plat plan provided by Port of Portland.
2) $^{+}$Indicates operating pumping well.
3) Contour interval of 2 foot.
4) Dashed contours represent contour interval outside of normal (2-foot) interval-included for additional clarity in selected areas.

Deep Zone Groundwater Elevations August 2016

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
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Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		11

APPENDIX D:

FLUORIDE DATA TABLES AND CONCENTRATION TREND PLOTS

Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW01-019	Silt	Along South Ditch	7/18/1994	24
			8/15/1994	22
			11/7/1994	56
			2/6/1995	28
			5/11/1995	34
			8/10/1995	30
			8/6/1996	33
			2/19/1997	30.7
			8/21/1997	22
			8/26/2010	40
			8/12/2015	33.2
MW02-012	Silt	Scrap Yard	8/7/1995	18
			12/4/1995	24
			2/13/1996	30
			5/15/1996	28
			8/7/1996	30
			2/24/1997	30.3
			8/20/1997	16
			8/24/2010	25
MW02-024	Silt	Scrap Yard	7/18/1994	22
			8/15/1994	21
			11/7/1994	18
			5/11/1995	27
			8/7/1995	22
			12/4/1995	14
MW02-034 (Deepened)	UGS		2/13/1996	1.1
			5/15/1996	3.1
			8/7/1996	5.7
			2/24/1997	6.7
			8/22/1997	6.0
			8/27/2003	6.4
			8/25/2004	6.18
			5/1/2005	8.81
			8/23/2005	8.4
			3/2/2006	7.9
			8/17/2006	10
			2/21/2007	6.26
			8/21/2007	5.1
			2/25/2008	8.74
			8/21/2008	8.38
			2/26/2009	7.4
			8/27/2009	7
			2/24/2010	7.6
			8/26/2010	9.4
			2/23/2011	9.58
			8/25/2011	9.7
			2/8/2012	8.8
			8/17/2012	7.99
			2/7/2013	9.28
			8/6/2013	8.51
			2/26/2014	9.73
			8/7/2014	10.3
			2/18/2015	9.98
			8/11/2015	9.95
			2/23/2016	9.80
			8/10/2016	9.25

See Notes on Last Page of Table

Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW03-017	Silt	Perimeter Upgradient-Background	7/18/1994	< 0.5
			11/7/1994	< 0.5
			2/7/1995	< 0.5
			5/10/1995	0.57
			8/9/1995	< 0.25
			8/8/1996	< 0.25
			11/21/1996	< 0.25
			2/17/1997	< 0.25
			5/16/1997	< 0.25
			8/22/1997	< 0.4
			11/7/1997	< 0.4
			2/16/1998	< 0.4
			8/14/1998	< 0.4
			2/25/1999	< 0.4
			8/17/1999	< 0.4
			Abandoned 12/22/2004	
MW03-098	Intermediate	Perimeter Upgradient-Background	8/7/1996	0.4
			11/21/1996	< 0.25
			2/17/1997	0.4
			5/16/1997	0.52
			8/22/1997	0.54
			11/7/1997	0.46
			2/16/1998	0.48
			8/14/1998	0.57
			2/25/1999	0.49
			8/17/1999	0.59
			Abandoned 12/22/2004	
MW03-175	Deep	Perimeter Upgradient-Background	8/7/1996	< 0.25
			11/21/1996	0.25
			2/17/1997	< 0.25
			5/16/1997	< 0.25
			8/22/1997	< 0.4
			11/7/1997	< 0.4
			8/25/2010	< 0.2
			8/13/2015	0.33
			8/11/2016	0.234
MW04-019	Silt	South Wetlands	7/18/1994	11
			8/15/1994	110
			11/7/1994	78
			2/6/1995	93
			5/11/1995	180
			8/7/1995	73
			8/6/1996	200
			2/21/1997	33.2
			8/21/1997	90.3
			8/25/2010	42
			8/12/2015	53.5
MW05-025	Silt	Perimeter - SE Upgradient-Background	2/25/1997	< 0.25
			7/18/1994	< 0.5
			8/8/1996	< 0.25
			11/21/1996	< 0.25
			5/14/1997	< 0.25
			8/21/1997	< 0.4
			11/5/1997	< 0.4

See Notes on Last Page of Table

Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW05-025 Continued			2/16/1998	< 0.4
			8/18/1998	< 0.4
			2/22/1999	< 0.4
			8/17/1999	< 0.4
			Abandoned 12/22/2004	
MW06-024	Silt	South of the Dike (Sundial Road)	7/18/1994	< 0.5
			11/8/1994	< 0.5
			2/7/1995	< 0.5
			5/10/1995	< 0.25
			8/10/1995	0.3
			8/6/1996	< 0.25
			11/19/1996	< 0.25
			2/20/1997	< 0.25
			5/14/1997	< 0.25
			8/19/1997	0.31
			11/5/1997	< 0.4
			Abandoned 12/22/2004	
MW06-094	Intermediate	South of the Dike (Sundial Road)	11/19/1996	13.6
			2/20/1997	13.4
			5/13/1997	13
			8/20/1997	16
			11/5/1997	15.9
			Abandoned 1/13/2005	
MW06-176	Deep	South of the Dike (Sundial Road)	8/6/1996	0.4
			11/19/1996	< 0.25
			2/20/1997	< 0.25
			5/14/1997	< 0.25
			8/20/1997	1.4
			11/5/1997	< 0.4
			Abandoned 1/3/2005	
MW07-024	Silt	South of the Dike	7/18/1994	< 0.5
			2/7/1995	< 0.5
			8/6/1996	< 0.25
			2/19/1997	< 0.25
			5/15/1997	< 0.25
			8/19/1997	0.32
			11/4/1997	< 0.4
			8/27/2010	0.25
			8/12/2015	0.31
			8/9/2016	0.243
MW08-027	UGS	Perimeter- Columbia River Boundary	7/18/1994	4.7
			8/15/1994	4.9
			11/8/1994	6.3
			2/7/1995	6.8
			5/10/1995	6.5
			8/10/1995	5.6
			2/7/1996	6.4
			8/5/1996	4.1
			11/19/1996	4.62
			2/17/1997	3.75
			5/12/1997	3.19
			8/18/1997	2.8
			11/3/1997	2.60
			Abandoned 1/11/2004	

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW08-127	Intermediate	Perimeter- Columbia River Boundary	8/5/1996	< 0.25
			11/18/1996	< 0.25
			2/17/1997	0.26
			5/12/1997	0.27
			8/18/1997	< 0.4
			11/3/1997	< 0.4
			Abandoned 1/5/2005	
MW08-169	Deep	Perimeter- Columbia River Boundary	5/24/1996	0.29
			8/5/1996	0.4
			11/18/1996	< 0.25
			2/17/1997	< 0.25
			5/12/1997	< 0.25
			8/18/1997	< 0.4
			11/4/1997	< 0.4
			Abandoned 1/5/2005	
MW09-030	UGS	North Landfill	8/15/1994	29
			11/8/1994	15
			2/7/1995	13
			5/10/1995	20
			8/10/1995	23
			2/7/1996	20
			8/5/1996	16
			2/17/1997	27.6
			8/18/1997	14
			2/19/1998	25.4
			8/13/1998	31.5
			2/24/1999	20.1
			8/25/1999	17.6
			2/21/2000	21.3
			8/25/2000	28.2
			3/8/2001	20.8
			8/28/2001	19.3
			2/27/2002	20.0
			8/23/2002	19.0
			8/27/2003	16.0
			Abandoned 1/3/2005	
MW10-023	Silt	South of Dike	8/15/1994	< 0.5
			2/6/1995	< 0.5
			8/7/1996	< 0.25
			11/20/1996	< 0.25
			2/25/1997	< 0.25
			5/13/1997	< 0.25
			8/25/1997	< 0.4
			11/10/1997	< 0.4
			2/18/1998	< 0.4
			8/18/1998	< 0.4
			3/5/1999	< 0.4
			8/16/1999	< 0.4
			3/2/2002	< 0.4
			8/22/2002	< 0.4
			2/27/2003	< 0.4
			8/25/2004	0.9
			8/23/2005	< 0.4
			3/1/2006	< 0.4
			8/17/2006	< 0.4
			2/22/2007	< 0.4
			8/21/2007	< 0.4
			2/27/2008	< 0.5

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW10-023 Continued			8/21/2008	< 0.5
			2/25/2009	< 0.2
			8/26/2009	< 0.2
			2/25/2010	< 0.2
			8/24/2010	< 0.2
			2/23/2011	< 0.2
			8/25/2011	0.2
			2/9/2012	< 0.2
			8/17/2012	< 0.2
			2/7/2013	< 0.2
			8/7/2013	< 0.2
			2/27/2014	0.17
			8/8/2014	0.10
			2/19/2015	0.11
			8/11/2015	0.14
			8/10/2016	0.122
MW10-090	Intermediate	South of Dike	11/20/1996	< 0.25
			2/25/1997	< 0.25
			5/13/1997	< 0.25
			8/20/1997	0.49
			11/10/1997	< 0.4
			2/18/1998	< 0.4
			8/18/1998	< 0.4
			3/5/1999	< 0.4
			8/16/1999	< 0.4
			3/2/2002	< 0.4
			8/23/2002	< 0.4
			2/27/2003	< 0.4
			8/25/2004	2.1
			2/28/2005	< 0.4
			8/23/2005	< 0.4
			3/1/2006	< 0.4
			8/17/2006	< 0.4
			2/22/2007	< 0.4
			8/2007	< 0.4
			2/28/2008	< 0.5
			8/20/2008	< 0.5
			2/25/2009	< 0.2
			8/26/2009	< 0.2
			2/25/2010	< 0.2
			8/24/2010	< 0.2
			2/23/2011	0.24
			8/25/2011	< 0.2
			2/9/2012	< 0.2
			8/17/2012	0.2
			2/7/2013	0.59
			8/7/2013	2.87
			2/27/2014	0.93
			8/8/2014	8.56
			2/19/2015	0.82
			8/11/2015	2.48
			2/24/2016	4.88
			8/10/2016	8.76
MW10-165	Deep	South of Dike	8/6/1996	0.3
			11/20/1996	< 0.25
			2/25/1997	< 0.25
			5/13/1997	< 0.25
			8/20/1997	0.46
			11/10/1997	< 0.4

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW10-165 Continued			2/18/1998	< 0.4
			8/18/1998	< 0.4
			3/5/1999	< 0.4
			8/16/1999	< 0.4
			3/2/2002	< 0.4
			8/23/2002	< 0.4
			2/26/2003	< 0.4
			8/25/2004	2.37
			2/28/2005	0.48
			8/23/2005	< 0.4
			3/1/2006	< 0.4
			8/17/2006	< 0.4
			2/22/2007	< 0.4
			8/2007	< 0.4
			2/28/2008	< 0.5
			8/20/2008	< 0.5
			2/25/2009	0.26
			8/26/2009	0.23
			2/25/2010	0.32
			8/24/2010	0.22
			2/23/2011	0.255
			8/25/2011	< 0.2
			2/9/2012	0.25
			8/17/2012	0.28
			2/7/2013	0.26
			8/7/2013	0.27
			2/27/2014	0.28
			8/8/2014	0.22
			2/19/2015	0.25
			8/13/2015	0.28
			2/25/2016	0.25
			8/11/2016	0.217
MW11-017	Silt	East Potliner	8/15/1994	570
			11/7/1994	490
			2/6/1995	490
			2/23/1995	460
			5/11/1995	510
			8/7/1995	400
			12/4/1995	390
			2/13/1996	640
			5/14/1996	460
			8/8/1996	260
			2/25/1997	522
			8/21/1997	396
			2/16/1998	385
			8/17/1998	440
			2/25/1999	306
			8/17/1999	300
			2/23/2000	296
			8/21/2000	261
			3/5/2001	300
			8/29/2001	313
			3/1/2002	198
			8/22/2002	289
			8/28/2003	274
			8/27/2004	263
			2/28/2005	160
			8/25/2005	289
			3/1/2006	314
			8/17/2006	343

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW11-017 Continued			2/22/2007	281
			8/24/2007	153
			2/25/2008	197
			8/21/2008	183
			2/26/2009	190
			8/26/2009	220
			2/25/2010	200
			8/24/2010	200
			2/23/2011	205
			8/24/2011	179
			2/8/2012	174
			8/17/2012	174
			2/5/2013	187
			8/6/2013	143
			2/26/2014	181
			8/7/2014	200
			2/19/2015	175
			8/12/2015	174
			2/25/2016	143
			8/10/2016	90.1
MW12-021	Silt	Perimeter- West (Sundial Road)	8/15/1994	< 0.5
			11/8/1994	< 0.5
			2/7/1995	< 0.5
			5/11/1995	< 0.25
			8/10/1995	0.45
			8/8/1996	< 0.25
			11/20/1996	< 0.25
			2/21/1997	< 0.25
			5/15/1997	< 0.25
			8/20/1997	< 0.4
			11/6/1997	< 0.4
			2/19/1998	< 0.4
			8/18/1998	0.47
			2/26/1999	0.59
			8/16/1999	0.51
			8/26/2010	0.34
			8/12/2015	3.91
			2/23/2016	4.43
			8/11/2016	2.72
MW12-092	Intermediate	Perimeter- West (Sundial Road)	11/20/1996	< 0.25
			2/21/1997	< 0.25
			5/15/1997	< 0.25
			8/20/1997	< 0.4
			11/6/1997	< 0.4
			2/19/1998	< 0.4
			8/18/1998	< 0.4
			2/26/1999	< 0.4
			8/16/1999	< 0.4
			8/26/2010	2.7
			8/12/2015	0.27
			2/23/2016	0.22
			8/11/2016	0.188
MW12-184	Deep	Perimeter- West (Sundial Road)	8/7/1996	< 0.25
			9/18/1996	< 0.25
			9/19/1996	< 0.25
			11/20/1996	< 0.25

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW12-184 Continued			2/21/1997	< 0.25
			5/15/1997	< 0.25
			8/20/1997	< 0.25
			11/6/1997	< 0.4
			Abandoned 12/9/2004	
MW13-022	Silt	Scrap Yard	8/7/1995	100
			12/4/1995	71
			2/9/1996	120
			5/13/1996	120
			8/7/1996	130
			2/24/1997	94
			8/20/1997	112
			2/19/1998	108
			8/17/1998	130
			2/25/1999	126
			8/18/1999	120
			2/23/2000	96
			8/21/2000	111
			3/5/2001	99
			8/29/2001	124
			3/1/2002	52.8
			8/23/2002	100
			8/27/2003	173
			8/27/2004	172
			3/2/2005	95.8
			8/24/2005	96.3
			3/1/2006	142
			8/17/2006	193
			2/22/2007	193
			8/24/2007	64.4
			2/25/2008	124
			8/20/2008	133
			2/26/2009	110
			8/27/2009	120
			2/25/2010	90
			8/24/2010	120
			2/21/2011	114
			8/24/2011	106
			2/8/2012	92
			8/17/2012	117
			2/5/2013	107
			8/6/2013	109
			2/26/2014	101
			8/7/2014	85
			2/18/2015	140
			8/11/2015	112
			8/10/2016	105
MW14-015	Silt	Scrap Yard	8/7/1995	6.8
			12/5/1995	5
			2/12/1996	6.9
			5/13/1996	5.9
			8/7/1996	6.3
			2/21/1997	6.03
			8/20/1997	9.1
			8/23/2010	4.0
			8/11/2015	4.05
			8/10/2016	3.10

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW15-024	Silt	Perimeter- West (Sundial Road)	8/8/1995	0.5
			2/7/1996	0.55
			8/9/1996	2.1
			11/20/1996	2.26
			2/21/1997	1.04
			5/15/1997	1.2
			8/25/1997	2.2
			11/10/1997	2.56
			8/26/2003	3.7
			Abandoned 12/9/2004	
MW15-086	Intermediate	Perimeter- West (Sundial Road)	11/20/1996	< 0.25
			2/21/1997	< 0.25
			5/15/1997	< 0.25
			8/25/1997	< 0.4
			11/10/1997	< 0.4
			2/16/1998	< 0.4
			8/18/1998	< 0.4
			2/26/1999	< 0.4
			8/16/1999	< 0.4
			8/26/2003	< 0.4
			Abandoned 12/9/2004	
MW15-175	Deep	Perimeter- West (Sundial Road)	8/7/1996	< 0.25
			11/20/1996	< 0.25
			2/21/1997	< 0.25
			5/15/1997	< 0.25
			8/25/1997	< 0.4
			11/10/1997	< 0.4
			8/26/2003	< 0.4
			Abandoned 12/9/2004	
MW16-014	Silt	South Landfill	8/9/1995	8
			12/7/1995	9
			2/8/1996	20
			5/16/1996	14
			8/8/1996	17
			2/18/1997	22.9
			5/16/1997	9.9
			8/22/1997	10.1
			8/26/2003	15.0
			8/28/2004	7.01
			8/24/2005	7.03
			8/25/2010	2.0
			8/13/2015	0.752
MW17-016	Silt	South Wetlands	8/8/1995	0.4
			12/8/1995	0.28
			2/8/1996	< 0.25
			5/16/1996	< 0.25
			8/8/1996	< 0.25
			2/18/1997	< 0.25
			8/22/1997	< 0.4
			Abandoned June 1998	
MW17-028	Silt	South Wetlands	8/9/1995	0.6
			12/7/1995	< 0.25
			2/8/1996	0.35
			5/16/1996	< 0.25
			8/8/1996	< 0.25
			2/18/1997	< 0.25
			8/22/1997	< 0.4

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Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW17-28 Continued			2/19/1998	< 0.4
			8/18/1998	< 0.4
			2/22/1999	< 0.4
			8/16/1999	< 0.4
			8/25/2010	< 0.2
			8/13/2015	0.115
			8/11/2016	0.104
MW18-016	Silt	South Wetlands	8/8/1995	4.4
			12/8/1995	5.4
			2/8/1996	6.4
			5/16/1996	7.5
			8/8/1996	7.1
			2/18/1997	7.54
			8/22/1997	7.2
			8/25/2010	11
			8/12/2015	12.5
			2/24/2016	12.7
			8/11/2016	11.9
MW18-031	UGS	South Wetlands	8/9/1995	0.85
			12/8/1995	0.28
			2/8/1996	0.56
			5/16/1996	0.4
			8/8/1996	< 0.25
			2/18/1997	< 0.25
			8/22/1997	< 0.4
			8/25/2010	< 0.2
			8/12/2015	0.17
			8/11/2016	0.146
MW19-013	Silt	South Landfill	8/9/1995	69
			12/7/1995	71
			2/9/1996	83
			5/16/1996	61
			8/8/1996	74
			2/19/1997	50.3
			8/22/1997	67
			8/19/1998	66.3
			2/22/1999	79.6
			8/18/1999	82
			8/21/2000	59.3
			3/6/2001	46.0
			8/31/2001	31.6
			3/2/2002	37.5
			8/22/2002	47.1
			2/27/2003	30.0
			8/25/2004	56.5
			3/1/2005	66
			8/24/2005	61.3
			3/2/2006	47.0
			8/16/2006	6.0
			2/20/2007	52.2
			8/24/2007	65
			2/25/2008	75.8
			8/20/2008	67.6
			2/25/2009	69
			8/27/2009	60
			2/25/2010	43
			8/25/2010	47
			2/22/2011	37.5

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Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW19-013 Continued			8/24/2011	45.6
			2/8/2012	39.5
			8/15/2012	41.6
			2/6/2013	42.5
			8/6/2013	37.5
			2/26/2014	36.2
			8/7/2014	30.1
			2/18/2015	26.6
			8/12/2015	27.7
			2/24/2016	26.5
			8/11/2016	19.1
MW20-026	UGS	North Landfill	9/11/1995	6.3
			12/6/1995	8
			2/7/1996	6.7
			5/13/1996	5
			8/6/1996	4.3
			2/18/1997	3.36
			5/12/1997	4.2
			8/19/1997	5
			11/4/1997	6.10
			Abandoned 12/7/2004	
MW21-012	Silt	North Landfill	9/11/1995	34
			12/5/1995	36
			2/6/1996	42
			5/10/1996	43
			8/5/1996	37
			11/20/1996	60.5
			2/18/1997	57.2
			8/18/1997	38.3
			Abandoned June 1998	
MW21-025	UGS	North Landfill	9/11/1995	11
			12/5/1995	6.1
			2/6/1996	11
			5/10/1996	13
			8/5/1996	21
			11/19/1996	10.7
			2/18/1997	12.6
			5/12/1997	13
			8/18/1997	12.1
			11/4/1997	10.1
			8/27/2003	20.0
		Abandoned October 2003 (Replaced by MW57-025)		
MW21-063	Intermediate	North Landfill	11/19/1996	< 0.4
			2/18/1997	< 0.25
			5/12/1997	< 0.25
			8/18/1997	< 0.4
			11/4/1997	0.42
			Abandoned 1/4/2005	
MW21-176	Deep	North Landfill	11/19/1996	< 0.25
			2/18/1997	< 0.25
			5/12/1997	< 0.25
			8/18/1997	< 0.4
			11/4/1997	< 0.4
			Abandoned 1/13/2005	

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Historical Fluoride Concentrations in Groundwater
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Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW22-027	UGS	North Landfill	9/11/1995	12
			12/6/1995	15
			2/7/1996	16
			5/13/1996	15
			8/5/1996	13
			2/19/1997	20.1
			5/12/1997	16.2
			8/19/1997	22
			11/4/1997	14.4
			2/19/1998	14.0
			8/20/1998	13.6
			2/24/1999	10.8
			8/25/1999	14.9
			2/22/2000	13.0
			8/24/2000	17.5
			3/8/2001	8.97
			9/5/2001	11.2
			Abandoned	
MW23-025	UGS	North Landfill	9/11/1995	19
			12/6/1995	14
			2/6/1996	16
			5/13/1996	14
			8/5/1996	9
			2/19/1997	18.2
			8/18/1997	9.1
			8/26/2004	46.4
			3/1/2005	24.1
			8/23/2005	19.3
			2/28/2006	11
			8/15/2006	8.5
			2/20/2007	9.8
			8/23/2007	18
			2/25/2008	18.3
			8/19/2008	40.7
			2/24/2009	37
			8/25/2009	34
			2/25/2010	27
			8/27/2010	22
			2/22/2011	13
			8/25/2011	6.49
			2/7/2012	25
			8/15/2012	10.9
			2/5/2013	12.1
			8/6/2013	17.6
			2/26/2014	34.7
			8/7/2014	2.75
			2/18/2015	35.4
			8/11/2015	39.6
			2/29/2016	16.0
			8/9/2016	19.3
MW24-010	Silt	Scrap Yard	8/8/1995	14
			12/4/1995	8.9
			2/13/1996	15
			5/14/1996	12
			8/6/1996	13

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Historical Fluoride Concentrations in Groundwater
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Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW24-010 Continued			2/24/1997	15.9
			8/20/1997	6.5
			8/24/2010	7.5
			8/11/2015	3.72
			8/10/2016	2.66
MW25-024	Silt	Scrap Yard	8/8/1995	18
			12/5/1995	21
			2/12/1996	31
			5/15/1996	24
			8/7/1996	24
			2/20/1997	26.6
			8/20/1997	24
			8/24/2010	11
			8/10/2015	16.4
MW25-035	UGS	Scrap Yard	8/8/1995	0.55
			12/5/1995	0.4
			2/12/1996	0.8
			5/15/1996	< 0.25
			8/7/1996	< 0.25
			2/20/1997	< 0.25
			8/22/1997	< 0.4
			3/1/2002	< 0.4
			8/23/2002	< 0.4
			2/27/2003	< 0.4
			Abandoned 12/7/2004	
MW26-012	Silt	South Landfill	8/9/1995	72
			12/7/1995	94
			2/9/1996	100
			5/16/1996	99
			8/8/1996	106
			2/19/1997	99.5
			8/21/1997	104
			2/16/1998	101
			8/17/1998	99.5
			2/25/1999	96.7
			8/18/1999	95
			2/23/2000	84.0
			8/21/2000	102
			3/5/2001	104
			8/29/2001	96.5
			3/2/2002	82.8
			8/22/2002	88.3
			2/27/2003	41.0
			8/25/2004	95.5
			3/1/2005	89.4
			8/24/2005	109
			3/2/2006	132
			8/16/2006	127
			2/20/2007	96.4
			8/24/2007	53.5
			2/25/2008	106
			8/20/2008	105
			2/24/2009	98
			8/27/2009	89
			2/25/2010	94
			8/25/2010	110
			2/22/2011	97.7
			8/24/2011	82.6

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Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW26-012 Continued			2/7/2012	82
			8/15/2012	74.3
			2/6/2013	74.1
			8/7/2013	68.7
			2/27/2014	76.2
			8/7/2014	65.6
			2/18/2015	66.6
			8/12/2015	53.7
			8/11/2016	84.9
MW26-050	UGS	South Landfill	10/2/2000	5.9
			3/5/2001	8.3
			8/29/2001	7.3
			3/2/2002	3.62
			8/22/2002	2.23
			2/27/2003	3.41
			8/25/2004	8.45
			3/1/2005	3.20
			8/24/2005	1.15
			3/2/2006	1.6
			8/16/2006	1.4
			2/20/2007	1.62
			8/24/2007	0.87
			2/27/2008	1.31
			8/20/2008	1.18
			2/24/2009	1.2
			8/27/2009	0.89
			2/25/2010	1.4
			8/25/2010	1.2
			2/22/2011	0.566
			8/24/2011	0.90
			2/7/2012	0.82
			8/15/2012	0.94
			2/6/2013	0.78
			8/7/2013	0.89
			2/27/2014	0.80
			8/7/2014	0.79
			2/18/2015	0.71
			8/12/2015	0.73
			8/11/2016	0.303
MW27-045	UGS	West of North Landfill North of Company Lake	11/21/1996	14.1
			2/19/1997	18.1
			5/13/1997	19.6
			8/19/1997	23
			11/4/1997	20.5
			2/19/1998	19.4
			8/18/1998	20.2
			2/23/1999	15.3
			8/25/1999	15.6
			2/22/2000	15.6
			8/25/2000	17.5
			3/8/2001	16.8
			8/28/2001	15.1
			2/27/2002	21.1
			8/23/2002	8.20
			2/28/2003	7.40
			8/27/2003	5.7
			8/24/2004	12.8
			3/8/2005	14.9
			8/23/2005	8.8

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Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW27-045 Continued			2/28/2006	8.2
			8/15/2006	8.4
			2/20/2007	6.76
			8/23/2007	8.9
			2/25/2008	8.85
			8/19/2008	7.6
			2/24/2009	8.3
			8/25/2009	7.4
			2/25/2010	49
			8/27/2010	7.8
			2/22/2011	7.77
			8/25/2011	8.36
			2/7/2012	7.8
			8/15/2012	7.81
			2/5/2013	8.23
			8/6/2013	8.67
			2/27/2014	11.3
			8/6/2014	7.46
			2/18/2015	4.2
			8/11/2015	9.64
			2/29/2016	8.05
			8/9/2016	7.15
MW27-081	Intermediate	West of North Landfill North of Company Lake	11/19/1996	20.2
			2/19/1997	19.1
			5/13/1997	21
			8/18/1997	26
			11/4/1997	22.3
			2/19/1998	22.1
			8/18/1998	22.3
			2/23/1999	24.1
			8/25/1999	23.4
			2/22/2000	24.4
			8/25/2000	25.1
			3/8/2001	22.7
			8/28/2001	20.7
			2/27/2002	29.2
			8/23/2002	23.1
			8/27/2003	27
			8/26/2004	64.4
			3/1/2005	39.4
			8/23/2005	26.6
			2/28/2006	27
			8/15/2006	27
			2/20/2007	18.5
			8/2007	25
			2/26/2008	23.8
			8/19/2008	24.1
			2/24/2009	28
			8/25/2009	25
			2/25/2010	26
			8/27/2010	26
			2/22/2011	27.6
			8/25/2011	49.4
			2/7/2012	26
			8/15/2012	26.4
			2/5/2013	28.5
			8/6/2013	28
			2/27/2014	29.6

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Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW27-081 Continued			8/6/2014	24.9
			2/18/2015	5.74
			8/11/2015	24.6
			2/29/2016	25.8
			8/9/2016	21.2
MW27-176	Deep	West of North Landfill North of Company Lake	11/19/1996	< 0.25
			2/19/1997	< 0.25
			5/13/1997	< 0.25
			8/19/1997	< 0.4
			11/4/1997	0.61
			Abandoned 1/11/2005	
MW28-160	Deep	Bakehouse	11/18/1996	< 0.25
			2/19/1997	< 0.25
			5/19/1997	< 0.25
			8/20/1997	< 0.4
			11/6/1997	< 0.4
			Abandoned 11/19/2007	
MW29-033	UGS	South of Dike South of Company Lake	11/21/1996	0.54
			2/20/1997	0.72
			5/14/1997	0.9
			8/19/1997	0.54
			11/5/1997	0.68
			8/27/2010	4.4
			8/25/2011	6.56
			8/11/2015	11.2
			2/23/2016	10.8
			8/9/2016	12.7
MW29-090	Intermediate	South of Dike South of Company Lake	11/19/1996	12.9
			2/20/1997	13.9
			5/14/1997	14.4
			8/19/1997	9.2
			11/5/1997	13.2
			2/17/1998	12
			8/11/1998	15
			3/3/1999	9.46
			8/24/1999	12
			2/25/2000	11.4
			8/23/2000	13.0
			3/7/2001	11.2
			9/5/2001	10.4
			2/28/2002	8.79
			8/21/2002	9.15
			2/28/2003	7.80
			8/26/2004	6.03
			8/22/2005	6.34
			3/1/2006	4.6
			8/18/2006	5.9
			2/22/2007	4.47
			8/2007	4.6
			2/26/2008	3.59
			8/19/2008	4.55
			2/25/2009	4.1
			8/26/2009	4.1
			2/25/2010	3.8
			8/25/2010	3.9
			2/22/2011	2.8
			8/25/2011	1.88
			2/8/2012	3.6

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Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW29-090 Continued			8/16/2012	4.91
			2/5/2013	3.22
			8/7/2013	4.51
			2/23/2014	2.57
			8/6/2014	3.93
			2/20/2015	2.60
			8/11/2015	2.42
			2/23/2016	2.41
			8/9/2016	4.20
MW29-179	Deep	South of Dike South of Company Lake	8/6/1996	1.1
			11/20/1996	1.61
			2/20/1997	1.81
			5/14/1997	2.04
			8/19/1997	1.3
			11/5/1997	2.35
			2/17/1998	2.63
			8/12/1998	3.7
			3/3/1999	4.24
			8/24/1999	5.40
			2/25/2000	6.03
			8/23/2000	6.60
			3/7/2001	6.90
			9/5/2001	6.78
			2/28/2002	3.06
			8/21/2002	5.43
			2/28/2003	6.00
			8/26/2004	6.89
			8/22/2005	7.24
			3/1/2006	6.70
			8/18/2006	8.80
			2/22/2007	8.0
			8/2007	7.9
			2/26/2008	7.80
			8/19/2008	7.69
			2/25/2009	8.6
			8/26/2009	8.1
			2/25/2010	8.7
			8/25/2010	9.2
			2/22/2011	7.96
			9/19/2011	9.00
			2/8/2012	7.80
			8/16/2012	8.26
			2/5/2013	8.83
			8/8/2013	8.24
			3/3/2014	9.96
			8/8/2014	8.35
			2/20/2015	8.70
			8/13/2015	9.35
			2/25/2016	9.08
			8/11/2016	9.79
MW30-030	UGS	Northwest - River Boundary	2/24/1997	0.25
			5/14/1997	0.32
			8/21/1997	0.55
			11/30/1997	0.79
			2/19/1998	< 0.4
			8/13/1998	0.85
			2/24/1999	0.41
			8/18/1999	0.50
			2/24/2000	0.52

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Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW30-030 Continued			8/22/2000	0.94
			3/7/2001	0.94
			8/31/2001	0.99
			2/28/2002	0.46
			8/20/2002	0.59
			8/25/2003	< 0.4
			8/26/2004	1.65
			2/28/2005	1.67
			8/22/2005	0.81
			8/26/2010	0.46
			8/13/2015	0.52
			8/9/2016	0.606
MW30-100	Intermediate	Northwest - River Boundary	2/24/1997	< 0.4
			5/14/1997	< 0.4
			8/21/1997	< 0.4
			11/5/1997	< 0.4
			2/19/1998	< 0.4
			8/13/1998	0.85
			2/24/1999	< 0.4
			8/18/1999	< 0.4
			2/24/2000	< 0.4
			8/22/2000	< 0.4
			3/7/2001	< 0.4
			8/31/2001	< 0.4
			2/28/2002	< 0.4
			8/20/2002	< 0.4
			8/25/2003	< 0.4
			8/26/2004	< 0.4
			8/22/2005	< 0.4
			8/26/2010	< 0.2
			8/13/2015	0.172
			8/9/2016	0.119
MW31-034	UGS	Perimeter - Fairview Farms	2/21/1997	< 0.25
			5/13/1997	0.3
			8/25/1997	< 0.4
			11/5/1997	< 0.4
			2/20/1998	4.97
			8/13/1998	< 0.4
			2/26/1999	< 0.4
			8/20/1999	0.47
			2/24/2000	0.46
			8/23/2000	< 0.4
			3/7/2001	< 0.4
			8/30/2001	< 0.4
			2/28/2002	< 0.4
			8/20/2002	< 0.4
			8/26/2003	< 0.4
			8/26/2004	1.13
			2/28/2005	< 0.4
			8/22/2005	< 0.4
			2/28/2006	< 0.4
			8/15/2006	< 0.4
			2/19/2007	< 0.4
			8/23/2007	< 0.4
			2/26/2008	< 0.5
			8/19/2008	< 0.5
			2/24/2009	0.27
			8/25/2009	0.22
			2/25/2010	0.25

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW31-034 Continued			8/27/2010	0.28
			2/22/2011	0.37
			8/25/2011	0.21
			2/7/2012	0.22
			8/15/2012	0.21
			2/6/2013	0.22
			8/7/2013	0.24
			2/26/2014	0.24
			8/6/2014	0.18
			2/18/2015	0.21
			8/13/2015	0.223
			8/9/2016	0.194
MW31-095R	Intermediate	Perimeter - Fairview Farms (Replaced 2005)	2/21/1997	20
			5/13/1997	23.1
			8/25/1997	24
			11/5/1997	25.4
			2/20/1998	6.58
			8/13/1998	20.9
			2/26/1999	17.4
			8/20/1999	21.1
			2/24/2000	19.5
			8/23/2000	19.6
			3/7/2001	17.4
			8/31/2001	15.1
			2/28/2002	13.6
			8/21/2002	15.1
			8/26/2003	15.0
			8/26/2004	26.5
			8/22/2005	18.3
			2/28/2006	16.0
			8/15/2006	12.0
			2/19/2007	14.4
			8/2007	15
			2/26/2008	14.3
			8/19/2008	13.1
			2/24/2009	16
			8/25/2009	12
			2/25/2010	13
			8/27/2010	12
			2/22/2011	9.63
			8/25/2011	8.19
			2/7/2012	8.7
			8/15/2012	10.8
			2/6/2013	10.6
			8/7/2013	9.28
			2/26/2014	10.7
			8/6/2014	8.73
			2/18/2015	9.86
			8/12/2015	9.22
			2/24/2016	10.3
			8/9/2016	8.04
MW32-040	UGS	Bakehouse	2/25/1997	0.28
			3/15/1997	0.41
			8/25/1997	0.45
			11/6/1997	0.49
			2/17/1998	< 0.4
			8/12/1998	0.84
			3/3/1999	0.62
			8/23/1999	0.75

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW32-040 Continued			2/22/2000	0.75
			8/22/2000	0.46
			3/6/2001	0.44
			8/29/2001	< 0.4
			8/21/2002	< 0.4
			8/27/2003	0.56
			8/25/2005	0.63
			3/3/2006	< 0.4
			8/17/2006	< 0.4
			2/21/2007	0.81
			8/22/2007	0.95
			Abandoned 11/20/2007	
MW32-095	Intermediate	Bakehouse	2/25/1997	0.42
			5/14/1997	0.6
			8/25/1997	0.64
			11/6/1997	0.50
			2/17/1998	< 0.4
			8/12/1998	0.61
			3/3/1999	0.48
			8/23/1999	0.57
			8/25/2005	0.48
			3/7/2006	< 0.4
			8/17/2006	0.53
			2/22/2007	< 0.4
			8/2007	0.69
			Abandoned 11/19/2007	
MW32-165	Deep	Bakehouse	2/25/1997	1.32
			5/14/1997	1.7
			8/25/1997	1.3
			11/6/1997	1.47
			8/25/2005	1.06
			3/7/2006	< 0.4
			8/17/2006	1.1
			2/22/2007	0.67
			Abandoned 11/19/2007	
MW33-033	UGS	Scrap Yard	2/25/1997	< 0.25
			5/16/1997	< 0.25
			8/25/1997	< 0.4
			11/6/1997	< 0.4
			3/1/2002	1.11
			8/21/2002	1.99
			2/26/2003	0.69
			8/27/2004	< 0.4
			3/2/2005	< 0.4
			8/24/2005	< 0.4
			3/3/2006	< 0.4
			8/18/2006	< 0.4
			2/21/2007	< 0.4
			8/22/2007	< 0.4
			2/27/2008	< 0.5
			8/20/2008	< 0.5
			2/25/2009	< 0.2
			8/27/2009	< 0.2
			2/25/2010	< 0.2
			8/23/2010	< 0.2
			2/23/2011	0.26
			8/25/2011	< 0.2
			2/9/2012	< 0.2

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW33-033 Continued			8/16/2012	< 0.2
			2/7/2013	< 0.2
			8/7/2013	< 0.2
			2/26/2014	0.17
			8/7/2014	0.13
			2/19/2015	0.13
			8/11/2015	0.16
			8/10/2016	0.145
MW33-095	Intermediate	Scrap Yard	2/25/1997	56.8
			5/16/1997	58
			8/25/1997	82.5
			11/6/1997	112
			2/17/1998	141
			8/11/1998	87.4
			3/4/1999	44.8
			8/24/1999	27.9
			2/21/2000	43.9
			8/22/2000	53.4
			3/6/2001	72.3
			8/29/2001	42.6
			3/1/2002	79.1
			8/21/2002	43.2
			2/26/2003	42.0
			8/27/2004	79
			3/2/2005	94.7
			8/24/2005	90.4
			3/7/2006	49
			8/18/2006	33
			2/22/2007	19.7
			8/2007	19
			2/29/2008	44.5
			8/20/2008	44.7
			2/25/2009	37
			8/27/2009	30
			2/25/2010	28
			8/23/2010	38
			2/23/2011	30
			8/25/2011	19.1
			2/9/2012	14.4
			8/16/2012	20.6
			2/7/2013	13.8
			8/7/2013	8.06
			2/27/2014	8.82
			8/7/2014	15.2
			2/19/2015	7.57
			8/11/2015	7.79
			2/23/2016	6.58
			8/10/2016	15.1
MW33-165	Deep	Scrap Yard	2/25/1997	17.2
			5/16/1997	19
			8/27/1997	23
			11/6/1997	25
			2/17/1998	40.7
			8/18/1998	22.4
			3/4/1999	20.3
			8/24/1999	16.1
			2/21/2000	16.4
			8/22/2000	22.8
			3/6/2001	22.0

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW33-165 Continued			8/29/2001	20.7
			3/1/2002	34.4
			8/21/2002	30.2
			2/26/2003	26.0
			8/27/2004	55.1
			3/2/2005	40.5
			8/24/2005	31.6
			3/7/2006	28
			8/18/2006	41
			2/22/2007	27.8
			8/2007	36
			2/29/2008	22.7
			8/19/2008	17.6
			2/25/2009	28
			8/27/2009	26
			2/25/2010	35
			8/23/2010	29
			2/23/2011	50.6
			8/25/2011	58.7
			2/9/2012	66
			8/16/2012	61.2
			2/7/2013	67.3
			8/7/2013	45.6
			2/27/2014	59.4
			8/8/2014	23.7
			2/19/2015	34.5
			8/13/2015	48.3
			2/25/2016	72.6
			8/11/2016	37.2
MW34-038	UGS	East Potliner	2/24/1997	29
			5/20/1997	35
			8/27/1997	28
			11/6/1997	33
			2/16/1998	28.4
			8/18/1998	35.4
			2/22/1999	37.5
			8/17/1999	48.0
			2/23/2000	47.0
			8/23/2000	49.0
			3/9/2001	43.2
			9/4/2001	33.1
			5/1/2002	51.3
			8/22/2002	36.3
			2/28/2003	35.0
			8/25/2004	88.7
			3/1/2005	91.7
			8/25/2005	77.3
			11/5/2005	82
			1/20/2006	100
			3/2/2006	81
			6/6/2006	80
			8/16/2006	86
			2/19/2007	75.3
			8/24/2007	67
			2/27/2008	82.5
			8/21/2008	86.2
			2/26/2009	76
			8/26/2009	92
			2/25/2010	84
			8/26/2010	110

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW34-038 Continued			2/23/2011	100
			8/24/2011	102
			2/8/2012	94
			8/17/2012	98.2
			2/5/2013	110
			8/6/2013	115
			2/26/2014	104
			8/7/2014	100
			2/18/2015	112
			8/12/2015	114
			2/23/2016	107
			8/10/2016	113
MW35-038	UGS	East Potliner	2/24/1997	5.02
			5/19/1997	3.9
			8/26/1997	6
			11/7/1997	1.74
			2/16/1998	< 0.4
			8/18/1998	< 0.4
			2/22/1999	< 0.4
			8/17/1999	3.40
			2/23/2000	3.30
			8/24/2000	6.27
			3/9/2001	4.26
			9/4/2001	6.26
			3/1/2002	4.43
			8/22/2002	6.86
			2/28/2003	8.80
			8/25/2004	21.3
			3/1/2005	20.4
			8/24/2005	11.8
			3/2/2006	4.4
			8/16/2006	74
			2/19/2007	129
			8/24/2007	76.1
			2/27/2008	56.8
			8/21/2008	8.94
			2/26/2009	17
			8/26/2009	10
			2/25/2010	4.8
			8/24/2010	5.8
			2/23/2011	0.59
			8/24/2011	1.08
			2/8/2012	1.5
			8/17/2012	0.65
			2/5/2013	1.01
			8/7/2013	0.44
			2/27/2014	3.64
			8/7/2014	3.46
			2/18/2015	0.49
			8/12/2015	13.5
			2/23/2016	1.02
			8/10/2016	2.22
MW36-006	Silt	South Ditch	2/21/1997	94.9
			5/16/1997	96
			8/27/1997	105
			11/4/1997	120
			Abandoned June 1998	

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW37-012	Silt	South Wetlands	2/20/1997	3.57
			5/20/1997	3.3
			8/25/1997	5.10
			11/10/1997	5.40
			Abandoned 12/21/2004	
MW37-030	UGS	South Wetlands	2/20/1997	0.45
			5/20/1997	0.34
			8/25/1997	0.33
			11/10/1997	< 0.4
			Abandoned 12/21/2004	
MW38-007	Silt	South Wetlands (Salmon Creek)	11/22/1996	< 0.25
			2/19/1997	< 0.25
			5/15/1997	< 0.25
			8/21/1997	< 0.4
			11/7/1997	< 0.4
			2/16/1998	< 0.4
			8/19/1998	< 0.4
			Abandoned 12/22/2004	
MW38-035	UGS	South Wetlands (Salmon Creek)	2/19/1997	< 0.4
			5/15/1997	< 0.4
			8/21/1997	< 0.4
			11/7/1997	< 0.4
			2/16/1998	< 0.4
			8/19/1998	< 0.4
			2/22/1999	< 0.4
			8/20/1999	< 0.4
			Abandoned 12/22/2004	
MW39-095	Intermediate	Perimeter-Fairview Farms	8/22/1997	< 0.4
			11/5/1997	< 0.4
			2/19/1998	< 0.4
			8/14/1998	< 0.4
			3/1/1999	< 0.4
			8/20/1999	< 0.4
			2/24/2000	< 0.4
			8/24/2000	< 0.4
			3/9/2001	< 0.4
			9/4/2001	< 0.4
			3/2/2005	< 0.4
			Abandoned June 2005	
MW40-018	Silt	Bakehouse	8/26/1997	1.0
			11/10/1997	2.17
			2/19/1998	2.32
			5/11/1998	5.70
			8/14/1998	5.20
			3/1/1999	6.94
			8/19/1999	4.50
			Abandoned 11/20/2007	
MW40-030	UGS	Bakehouse	8/27/1997	1.1
			11/11/1997	1.26
			2/19/1998	1.57
			5/11/1998	1.49
			8/14/1998	1.4
			3/1/1999	1.25
			8/19/1999	1.9
			Abandoned 11/20/2007	

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW41-020	Silt	Bakehouse	8/26/1997	0.63
			11/11/1997	0.40
			2/17/1998	0.78
			5/11/1998	0.93
			8/12/1998	0.68
			Abandoned 12/8/2004	
MW41-033	UGS	Bakehouse	8/27/1997	1.1
			11/11/1997	1.33
			2/17/1998	0.94
			5/13/1998	0.91
			8/11/1998	0.59
			3/3/1999	0.58
			8/23/1999	0.67
			Abandoned 12/8/2004	
MW42-013	Silt	Bakehouse	8/28/1997	Dry
			11/11/1997	Dry
			2/17/1998	Dry
			5/13/1998	Dry
			8/18/1998	Dry
			3/2/1999	16.2
			8/23/1999	Dry
			Abandoned 11/20/2007	
MW42-027	UGS	Bakehouse	8/27/1997	16.1
			11/10/1997	14.4
			2/18/1998	16.8
			5/11/1998	17.2
			8/12/1998	22.0
			3/2/1999	16.8
			8/23/1999	19.6
			3/1/2006	13.0
			8/17/2006	19.0
			2/21/2007	14.3
			8/24/2007	19
			Abandoned 11/20/2007	
MW43-015	Silt	Bakehouse	8/26/1997	Dry
			11/11/1997	Dry
			2/18/1998	6.28
			5/13/1998	9.5
			8/25/1998	Dry
			3/2/1999	7.73
			8/23/1999	Dry
			Abandoned 12/10/2004	
MW43-027	UGS	Bakehouse	8/26/1997	8.42
			11/11/1997	8.29
			2/18/1998	5.42
			5/13/1998	8.1
			8/12/1998	9.2
			3/2/1999	8.5
			8/23/1999	8.6
			Abandoned 12/10/2004	
MW44-011	Silt	Bakehouse	8/28/1997	Dry
			11/11/1997	Dry
			2/18/1998	Dry
			5/12/1998	Dry
			8/12/1998	Dry
			Abandoned July 2004	

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Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW44-027	UGS	Bakehouse	8/26/1997	6.4
			11/11/1997	5.0
			2/20/1998	6.0
			5/12/1998	3.8
			8/12/1998	3.1
			Abandoned July 2004	
MW45-017	Sit	Bakehouse	8/25/1997	9.2
			11/7/1997	12.3
			2/20/1998	13
			5/12/1998	9.2
			8/13/1998	12.6
			3/1/1999	10.9
			8/19/1999	11.5
			Abandoned 12/9/2004	
MW45-042	UGS	Bakehouse	8/20/1997	0.73
			11/7/1997	1.4
			2/20/1998	0.89
			5/12/1998	0.91
			8/13/1998	0.7
			Abandoned 12/8/2004	
MW46-018	Silt	Bakehouse	8/25/1997	28
			11/11/1997	21.1
			2/20/1998	18.9
			5/12/1998	16.8
			8/10/1998	19.2
			3/1/1999	20.2
			8/19/1999	15.2
			8/26/2010	18
			8/13/2015	9.15
			8/11/2016	11.0
MW46-043	UGS	Bakehouse	8/21/1997	1.5
			11/11/1997	1.12
			2/20/1998	0.90
			5/12/1998	0.86
			8/10/1998	0.84
			3/1/1999	0.59
			8/20/1999	0.49
			8/26/2010	0.45
			8/13/2015	0.53
			8/11/2016	0.342
MW47-094	Intermediate	South Landfill	8/21/1997	0.26
			11/11/1997	< 0.4
			8/25/2010	0.21
			8/12/2015	0.31
			8/11/2016	0.627
MW48-055	Intermediate	North Side of Casthouse	11/19/1997	0.66
			2/18/1998	< 0.4
			8/11/1998	< 0.4
			3/4/1999	< 0.4
			8/24/1999	< 0.4
			Abandoned 12/8/2004	
MW48-165	Deep	Bakehouse	11/19/1997	7.02
			2/18/1998	7.4
			8/11/1998	8
			3/4/1999	6.46
			8/24/1999	7.80

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW48-165 Continued			2/25/2000	7.60
			8/21/2000	9.61
			3/6/2001	8.46
			9/5/2001	8.36
			3/2/2002	5.83
			8/21/2002	7.97
			2/27/2003	7.40
			8/26/2004	5.20
			8/23/2005	5.04
			3/7/2006	4.2
			8/17/2006	6.00
			2/22/2007	4.65
			8/2007	6.1
			2/28/2008	5.68
			8/19/2008	5.55
			2/25/2009	6.1
			8/27/2009	6.2
			2/25/2010	6.5
			8/25/2010	5.3
			2/22/2011	< 0.2
			8/28/2011	6.76
			2/9/2012	2.4
			8/16/2012	6.14
			2/6/2013	1.21
			8/8/2013	2.45
			3/3/2014	3.54
			8/8/2014	3.77
			2/20/2015	0.178
			8/13/2015	1.88
			2/25/2016	< 0.10
			8/11/2016	3.77
MW49-095	Intermediate	Scrap Yard	11/18/1997	< 0.4
			2/17/1998	< 0.4
			8/17/1998	< 0.4
			3/2/1999	< 0.4
			8/19/1999	0.35
			8/25/2010	0.23
			8/11/2015	0.30
			8/10/2016	0.289
MW49-145	Deep	Scrap Yard	11/18/1997	1.24
			2/17/1998	0.59
			8/17/1998	0.5
			3/2/1999	0.47
			8/19/1999	0.54
			8/25/2010	0.48
			8/13/2015	0.373
			8/11/2016	0.326
MW50-094	Intermediate	South Side of Casthouse	11/19/1997	< 0.4
			2/17/1998	< 0.4
			8/17/1998	< 0.4
			3/4/1999	1.00
			8/23/1999	0.64
			8/25/2010	0.23
			8/12/2015	2.83
			2/24/2016	3.19
			8/10/2016	0.156

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW51-069	Intermediate	Northwest- Columbia River Boundary	11/18/1997	0.27
			2/17/1998	< 0.4
			5/11/1998	< 0.4
			8/10/1998	< 0.4
			2/24/1999	< 0.4
			8/18/1999	< 0.4
			2/25/2000	< 0.4
			8/23/2000	< 0.4
			3/7/2001	< 0.4
			8/31/2001	< 0.4
			2/28/2002	0.51
			8/20/2002	< 0.4
			Abandoned	
MW52-045	UGS	Northwest- Columbia River Boundary	11/10/1997	9.26
			2/18/1998	10.8
			5/11/1998	6.11
			8/10/1998	10.3
			2/23/1999	10
			8/25/1999	9.8
			2/22/2000	9.7
			8/24/2000	10.2
			3/9/2001	11.4
			9/5/2001	10.4
			2/27/2002	12.6
			8/23/2002	8.30
			8/26/2003	5.20
			8/24/2004	11.10
			3/1/2005	10.6
			8/23/2005	9.42
			3/1/2006	5.5
			8/15/2006	5.8
			2/20/2007	3.6
			8/23/2007	5.3
			2/26/2008	6.89
			8/19/2008	6.41
			2/24/2009	6.9
			8/25/2009	5.8
			2/25/2010	0.61
			8/27/2010	6.2
			2/22/2011	6.13
			8/25/2011	6.66
			2/7/2012	6.1
			8/15/2012	6.22
			2/5/2013	7.08
			8/6/2013	6.28
			2/26/2014	7.18
			8/6/2014	6.46
			2/18/2015	4.99
			8/11/2015	6.52
			2/29/2016	4.26
			8/9/2016	4.68
MW53-034	UGS	Sandy River Boundary (East Lake)	11/11/1997	2.59
			2/18/1998	2.84
			5/11/1998	2.49
			8/10/1998	3.04
			2/23/1999	2.68
			8/25/1999	3.09
			2/22/2000	3.50
			8/24/2000	3.13

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW53-034 Continued			3/9/2001	3.07
			9/5/2001	3.91
			2/27/2002	3.53
			8/23/2002	2.37
			8/27/2003	2.8
			8/26/2004	3.24
			8/23/2005	3.60
			2/28/2006	3.70
			8/15/2006	3.30
			2/20/2007	3.05
			8/23/2007	3.0
			2/26/2008	3.37
			8/19/2008	2.72
			2/24/2009	3.1
			8/25/2009	2.5
			2/25/2010	2.5
			8/27/2010	2.6
			2/22/2011	3.08
			8/25/2011	3.03
			2/8/2012	2.8
			8/15/2012	2.95
			2/5/2013	2.36
			8/6/2013	2.83
			2/26/2014	2.77
			8/6/2014	2.51
			2/18/2015	2.42
			8/11/2015	2.54
			2/29/2016	2.42
			8/9/2016	2.19
MW54-050	UGS	South Landfill	10/3/2000	5.70
			3/6/2001	1.62
			8/31/2001	0.66
			3/2/2002	< 0.4
			8/22/2002	0.80
			2/27/2003	< 0.4
			Abandoned 1/3/2005	
MW55-046	UGS	Scrap Yard	8/27/2003	134
			8/27/2004	91
			3/2/2005	83
			8/24/2005	75
			11/7/2005	68
			1/20/2006	99
			3/3/2006	141
			6/6/2006	104
			8/17/2006	101
			2/21/2007	81
			8/24/2007	73
			2/27/2008	84
			8/20/2008	74.7
			2/26/2009	62
			8/27/2009	64
			2/25/2010	64
			8/24/2010	55
			2/21/2011	71.5
			8/24/2011	61.8
			2/8/2012	63
			8/17/2012	61.3
			2/5/2013	59.8
			8/6/2013	57.7
			2/26/2014	60.1

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW55-046 Continued			8/7/2014	56.5
			2/18/2015	56.6
			8/11/2015	52.4
			2/23/2016	46.3
			8/10/2016	50.2
MW56-046	UGS	Scrap Yard	8/28/2003	24.0
			8/27/2004	27.2
			3/2/2005	43.0
			8/25/2005	36.4
			11/7/2005	40.0
			1/20/2006	18.2
			3/3/2006	18.0
			6/6/2006	21.0
			8/16/2006	22.0
			2/21/2007	18.4
			8/22/2007	22
			2/27/2008	19.4
			8/21/2008	27.6
			2/26/2009	26
			8/27/2009	31
			2/25/2010	27
			8/23/2010	30
			2/21/2011	32.8
			8/24/2011	36.1
			2/7/2012	35
			8/17/2012	36.5
			2/5/2013	42.5
			8/6/2013	45.9
			2/26/2014	33.2
			8/7/2014	30.9
			2/19/2015	28.1
			8/11/2015	37.9
			2/23/2016	18.2
			8/10/2016	20.0
MW57-025	UGS	North Landfill (Replaces MW21-025)	8/27/2004	15.3
			3/1/2005	16.3
			8/23/2005	10.8
			2/28/2006	9.9
			8/15/2006	5.9
			2/20/2007	7.7
			8/23/2007	17
			2/25/2008	18.4
			8/19/2008	30.1
			2/24/2009	16
			8/25/2009	13
			2/25/2010	8.6
			8/27/2010	16
			2/22/2011	10.2
			8/25/2011	0.61
			2/7/2012	11.6
			8/15/2012	9.34
			2/5/2013	16.5
			8/6/2013	31.3
			2/26/2014	13.4
			8/7/2014	11.9
			2/18/2015	10.5
			8/31/2015	11.4
			2/29/2016	8.25
			8/9/2016	11.7

See Notes on Last Page of Table

Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
MW58-042	UGS	East Potliner	10/3/2006	4.5
			2/21/2007	5.8
			8/24/2007	4.7
			2/29/2008	4.15
			8/21/2008	3.86
			2/26/2009	3.2
			8/26/2009	2.6
			2/25/2010	2.3
			8/26/2010	1.8
			2/23/2011	2.7
			8/24/2011	2.52
			2/8/2012	1.4
			8/17/2012	1.4
			2/7/2013	2.76
			8/7/2013	2.6
			2/27/2014	2.87
			8/8/2014	2.36
			2/19/2015	1.21
			8/12/2015	1.09
			8/10/2016	0.861
MW59-019	Silt	Plant Interior	11/30/2009	33.9
			2/25/2010	24
			8/26/2010	24
			2/22/2011	25.2
			8/25/2011	2
			2/7/2012	19.8
			8/16/2012	18.1
			2/6/2013	19.2
			8/7/2013	17.6
			2/27/2014	16.0
			8/8/2014	13.6
			2/20/2015	6.70
			8/13/2015	12.0
			2/24/2016	9.53
			8/11/2016	11.7
MW59-038	UGS	Plant Interior	11/30/2009	1.21
			2/25/2010	2.0
			8/26/2010	1.7
			2/22/2011	1.49
			8/25/2011	1.38
			2/7/2012	1.6
			8/16/2012	1.37
			2/6/2013	1.28
			8/7/2013	1.51
			2/27/2014	1.41
			8/8/2014	1.35
			2/20/2015	1.36
			8/13/2015	< 0.10
			2/24/2016	1.72
			8/11/2016	1.51
FE01-046	UGS	Scrap Yard	3/7/2006	43.0
			8/16/2006	51.0
			2/20/2007	54.4
			8/22/2007	54
			2/28/2008	48.1
			8/21/2008	52.1
			2/26/2009	53
			8/27/2009	60

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
FE01-046 Continued			2/25/2010	57
			8/24/2010	46
			2/21/2011	54.3
			8/24/2011	47
			2/7/2012	39
			8/17/2012	38.2
			2/5/2013	43.9
			8/6/2013	69
			2/26/2014	76.2
			8/7/2014	35.9
			2/18/2015	37.6
			8/11/2015	30.2
			2/23/2016	33.9
			8/10/2016	30.3
FE02-046	UGS	Scrap Yard	8/2/2004	79.7
			8/25/2004	97.3
			3/2/2005	65.8
			8/25/2005	97.3
			11/4/2005	55.0
			11/14/2005	60.0
			11/15/2005	53.4
			11/17/2005	47.2
			11/21/2005	50.1
			11/23/2005	50.8
			12/21/2005	45.2
			1/20/2006	37.0
			3/3/2006	37.0
			4/3/2006	40.0
			5/1/2006	35.0
			6/6/2006	33.8
			8/16/2006	32.0
			12/14/2006	29.6
			2/19/2007	30.7
			8/21/2007	23
			2/28/2008	25.4
			8/21/2008	28.4
			2/26/2009	48
			8/27/2009	53
			2/25/2010	67
			8/24/2010	65
			2/21/2011	21.9
			8/24/2011	73.4
			2/7/2012	60
			8/17/2012	36.6
			2/5/2013	87.6
			8/6/2013	74.7
			2/26/2014	69.6
			8/7/2014	23.5
			2/18/2015	66.3
			8/11/2015	54.4
			2/23/2016	22.6
			8/11/2016	25.9
FE03-045	UGS	Scrap Yard	6/8/2004	5.18
			8/24/2005	10.4
			11/7/2005	11.00
			11/21/2005	12.20
			11/23/2005	8.70
			12/21/2005	19.20
			1/20/2006	20.80

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
FE03-045 Continued			3/3/2006	21.00
			4/3/2006	23.00
			5/1/2006	28.00
			6/6/2006	33.00
			8/16/2006	69.00
			12/14/2006	30.10
			2/19/2007	31.20
			8/21/2007	29
			2/28/2008	26.7
			8/21/2008	23.4
			2/26/2009	27
			8/26/2009	24
			2/25/2010	22
			8/25/2010	20
			2/23/2011	15.1
			8/24/2011	18.2
			2/8/2012	14.2
			8/17/2012	22.8
			2/5/2013	22.7
			8/7/2013	9.04
			2/26/2014	9.43
			8/7/2014	8.58
			2/18/2015	29.4
			8/12/2015	8.92
			2/23/2016	25.5
			8/10/2016	18.9
FE04-071	UGS	Scrap Yard	8/22/2007	< 0.4
			2/27/2008	1.75
			8/21/2008	1.63
			2/26/2009	1.6
			8/26/2009	1.5
			2/25/2010	< 0.2
			8/24/2010	1.7
			2/21/2011	1.83
			8/24/2011	2.04
			2/7/2012	2
			8/17/2012	2.6
			2/5/2013	2.63
			8/6/2013	11.1
			2/26/2014	8.66
			8/7/2014	7.00
			8/11/2015	6.96
			2/23/2016	6.70
			8/10/2016	8.78
FE05-074	UGS	Scrap Yard	8/21/2007	29
			2/27/2008	30.6
			8/21/2008	23.8
			2/26/2009	19
			8/26/2009	18
			2/25/2010	15
			8/25/2010	16
			2/23/2011	12.8
			8/24/2011	14.5
			2/8/2012	12.2
			8/17/2012	13.3
			2/5/2013	14.8
			8/6/2013	14.4

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
FE05-074 Continued			2/26/2014	11.7
			8/7/2014	11.0
			2/19/2015	11.1
			8/12/2015	7.16
			2/23/2016	9.39
			8/10/2016	8.66
FE06-047	UGS	Scrap Yard	8/6/2013	69
			8/21/2014	7.18
			2/20/2015	11.3
			8/31/2015	60.6
			2/23/2016	50.7
			8/10/2016	48.1
PW03	Deep	North Side Bakehouse	8/16/1994	0.5
			10/23/1995	0.29
			10/26/1995	0.31
			5/19/1997	0.38
			3/3/2006	0.44
			5/1/2006	0.6
			8/17/2006	0.55
			2/19/2007	0.52
			8/2007	0.46
			2/28/2008	< 0.5
			8/21/2008	0.43
			8/27/2009	0.71
			2/25/2010	0.69
			8/26/2010	0.41
			2/22/2011	0.437
			8/22/2011	0.295
			2/6/2012	0.46
			8/16/2012	0.47
			2/6/2013	0.66
			8/7/2013	0.41
			2/25/2014	0.34
			8/8/2014	0.60
			2/18/2015	0.78
			8/13/2015	1.39
			2/24/2016	1.27
PW05	Deep	Plant Interior	3/3/2006	0.45
			8/16/2006	< 0.4
			2/19/2007	< 0.4
			8/2007	< 0.4
			2/28/2008	< 0.5
			8/21/2008	0.58
			2/26/2009	< 0.2
			8/26/2009	< 0.2
			2/25/2010	0.44
			8/26/2010	0.45
			2/22/2011	2.66
			8/22/2011	< 0.2
			2/6/2012	0.28
			8/16/2012	0.25
			2/6/2013	0.23
			8/7/2013	0.40
			2/25/2014	0.17
			8/14/2014	0.24
			8/13/2015	0.28
			8/10/2016	1.24

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Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
PW07	Deep	Northeast Side of Bakehouse	8/16/1994	0.5
			10/23/1995	< 0.4
			10/26/1995	< 0.4
			6/18/1998	0.4
			7/16/1998	0.45
			3/3/2006	< 0.4
			5/1/2006	0.61
			6/1/2006	< 0.4
			8/16/2006	< 0.4
			12/14/2006	< 0.4
			2/16/2007	< 0.4
			8/2007	< 0.4
			2/28/2008	< 0.5
			8/21/2008	0.2
			2/26/2009	< 0.2
			8/26/2009	< 0.2
			2/25/2010	< 0.2
			8/26/2010	0.35
			2/22/2011	< 0.2
			8/22/2011	< 0.2
			8/16/2012	0.20
			2/6/2013	0.22
			8/7/2013	0.20
			2/25/2014	0.98
			8/8/2014	0.21
			2/18/2015	0.22
			8/13/2015	0.26
			2/24/2016	0.20
			8/10/2016	0.224
PW08	Deep	Northeast Side of Bakehouse	8/16/1994	1.3
			11/8/1994	1.2
			2/8/1995	1.5
			5/10/1995	1.2
			8/11/1995	1.6
			10/23/1995	1.1
			10/26/1995	1.4
			12/8/1995	0.95
			2/9/1996	1.3
			6/19/1998	2.12
			7/16/1998	1.99
			3/3/2006	3.1
			4/3/2006	3.5
			5/1/2006	3.6
			6/6/2006	3.2
			8/16/2006	3.1
			12/14/2006	2.6
			2/19/2007	3.1
			8/2007	2.4
			2/28/2008	2.94
			8/21/2008	3.28
			2/26/2009	2.7
			8/26/2009	3.2
			2/25/2010	3.0
			8/26/2010	2.8
			2/22/2011	2.62
			8/22/2011	2.48
			2/6/2012	3.0
			8/16/2012	2.35
			2/6/2013	2.81

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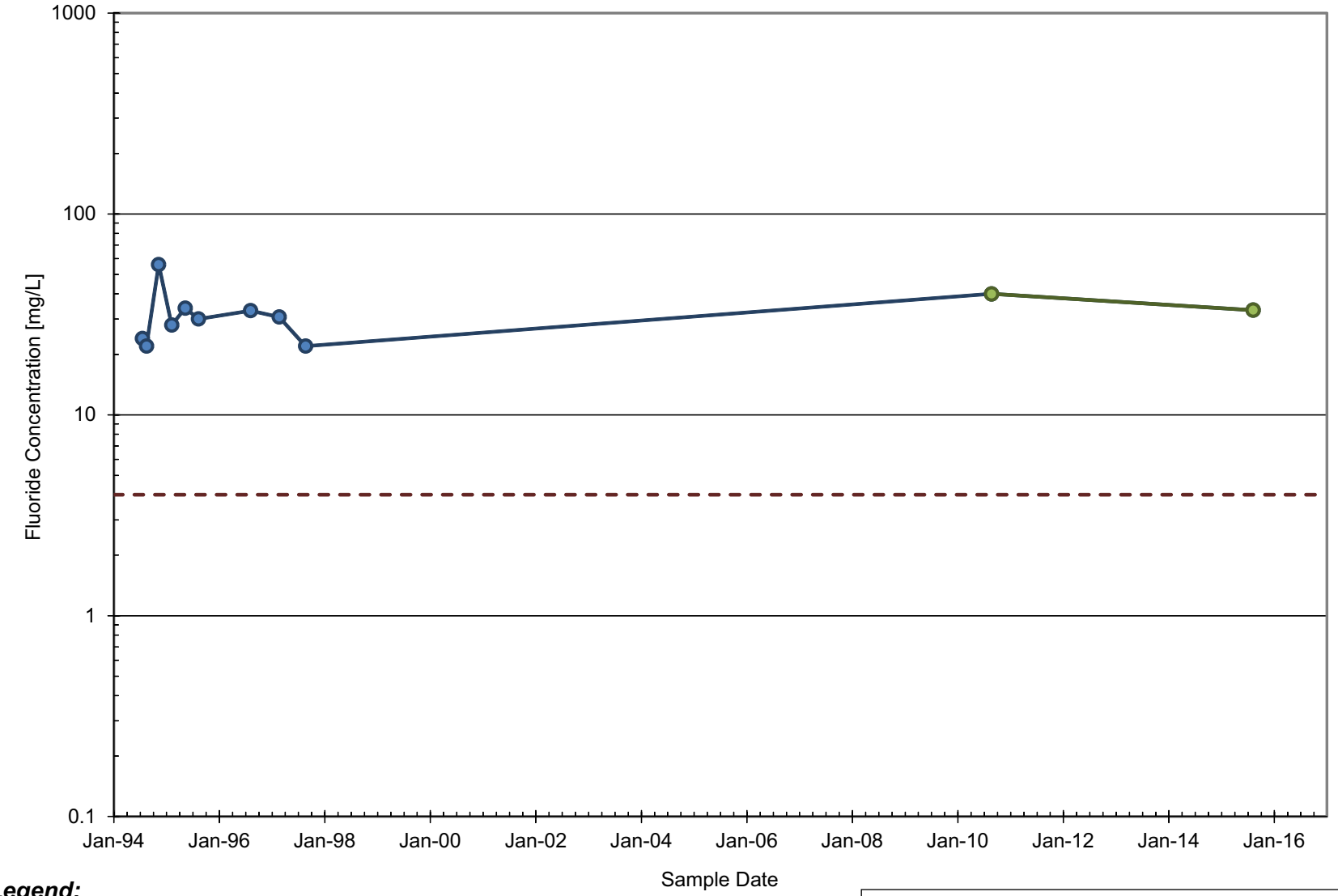
Table B-1
Historical Fluoride Concentrations in Groundwater
Port of Portland – Troutdale Reynolds Industrial Property

Well ID	Zone	Area Monitored	Date Sampled	Fluoride Concentration [mg/L]
PW08 Continued			8/7/2013	2.42
			2/25/2014	2.62
			8/8/2014	2.47
			2/18/2015	0.47
			8/13/2015	2.41
			2/24/2016	2.12
			8/10/2016	2.15
PW10	Deep	Between Casthouse and Bakehouse	8/16/1994	< 0.5
			11/8/1994	< 0.5
			2/8/1995	1.0
			5/10/1995	0.36
			8/11/1995	0.3
			10/23/1995	< 0.25
			10/26/1995	< 0.25
			12/8/1995	0.37
			2/9/1996	0.37
			5/15/1996	0.37
			8/9/1996	< 0.25
			11/22/1996	< 0.25
			2/26/1997	< 0.25
			5/19/1997	0.27
			8/28/1997	< 0.4
			6/18/1998	0.31
			7/16/1998	0.42
			Decommissioned 1/16/2008	
PW11	Deep		3/29/1996	0.35
			Decommissioned	
PW12	Deep		4/1/1996	0.31
			Decommissioned	
PW16	Deep		4/2/1996	1.3
			Decommissioned	
PW18	Deep	East Side of Scrap Yard	8/16/1994	0.64
			11/8/1994	< 0.5
			2/8/1995	0.61
			5/10/1995	0.4
			8/11/1995	0.4
			12/8/1995	0.38
			2/8/1996	0.39
			5/15/1996	< 0.25
			8/9/1996	< 0.25
			11/22/1996	< 0.25
			2/26/1997	0.26
			5/19/1997	0.33
			8/28/1997	0.27
			Decommissioned	

Notes:
mg/L = Milligrams per liter.
< = Not detected at or above the method reporting limit (MRL).
Shaded wells indicate wells not sampled during this reporting period.



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

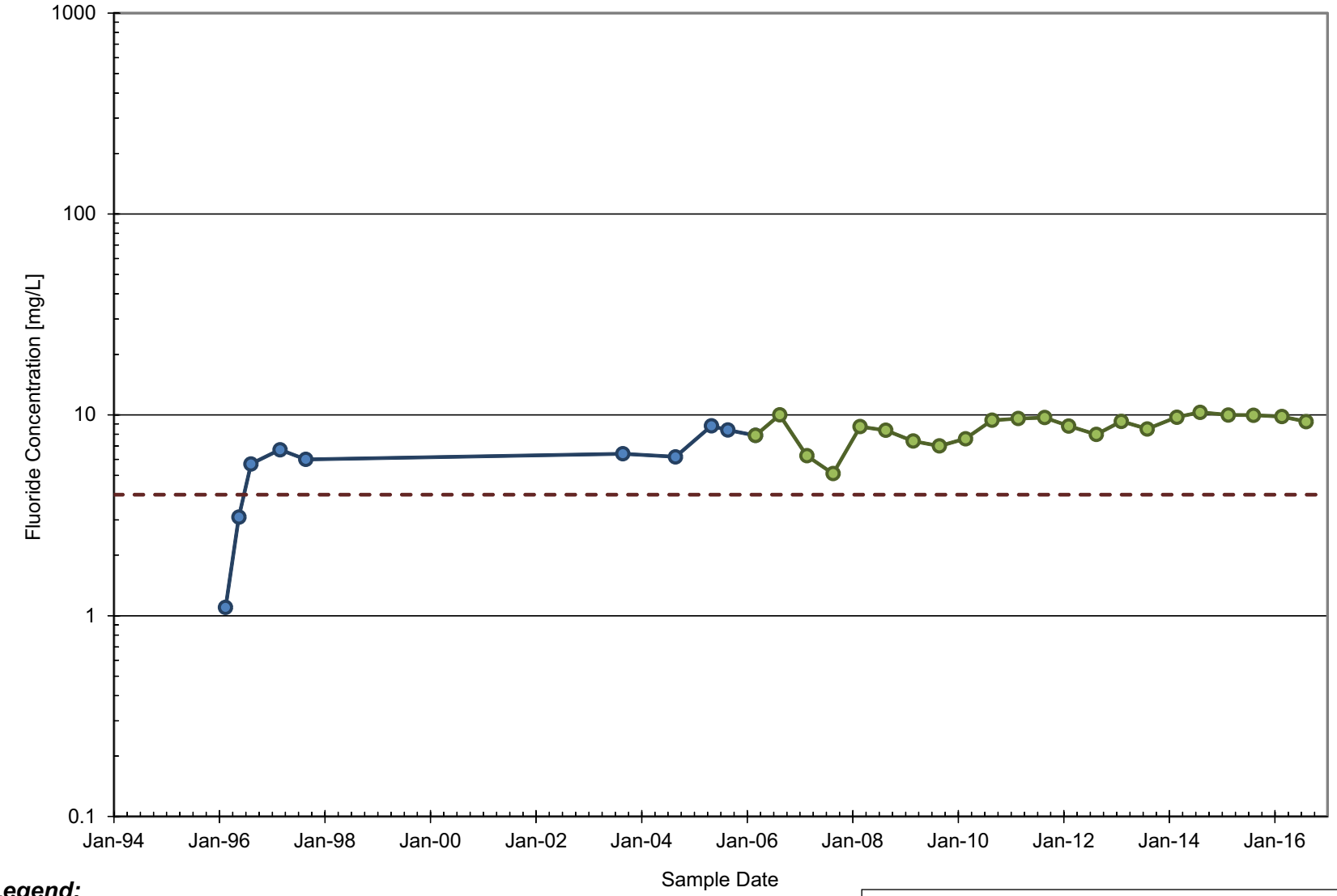
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW01-019

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-1



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

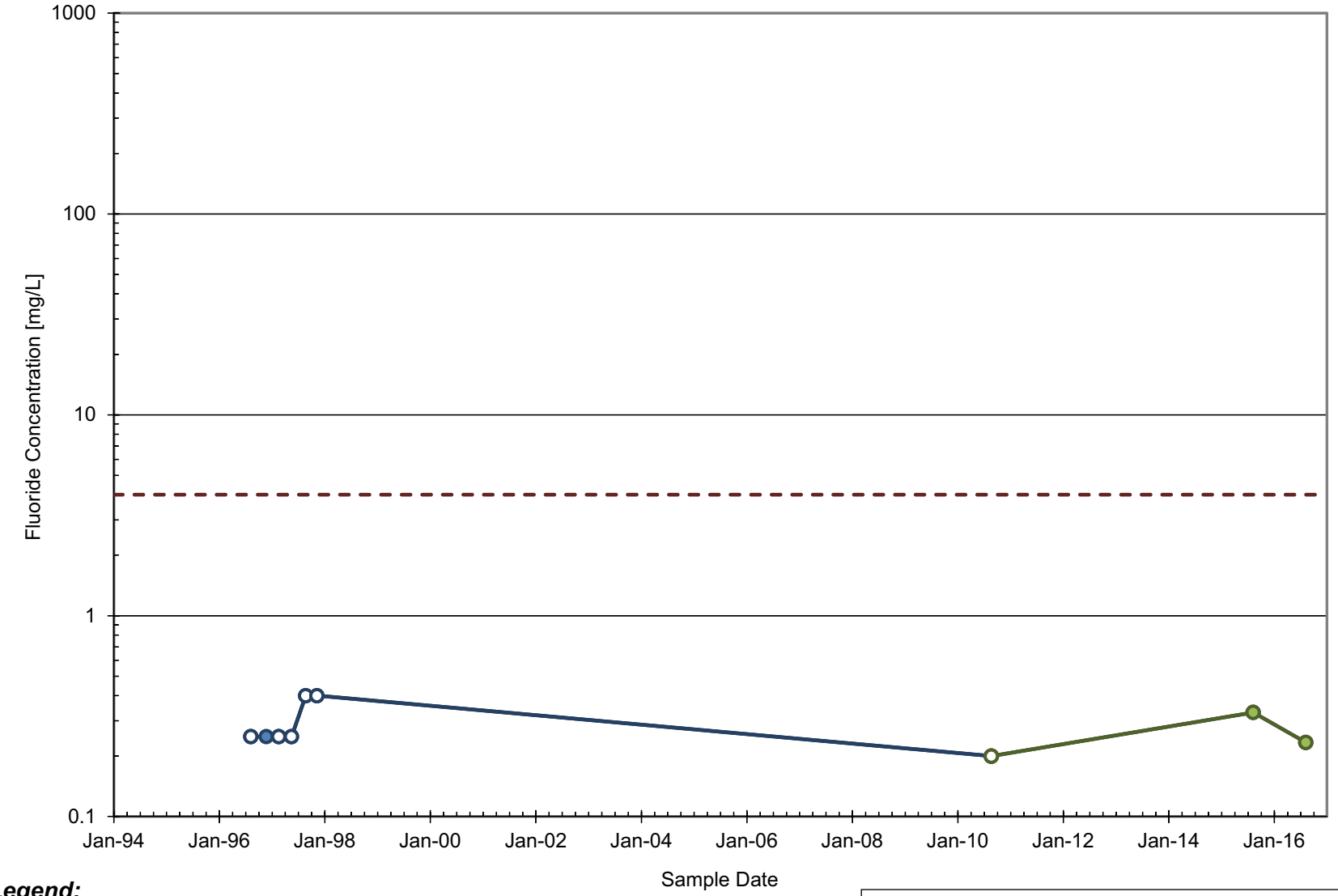
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW02-034

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-2



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

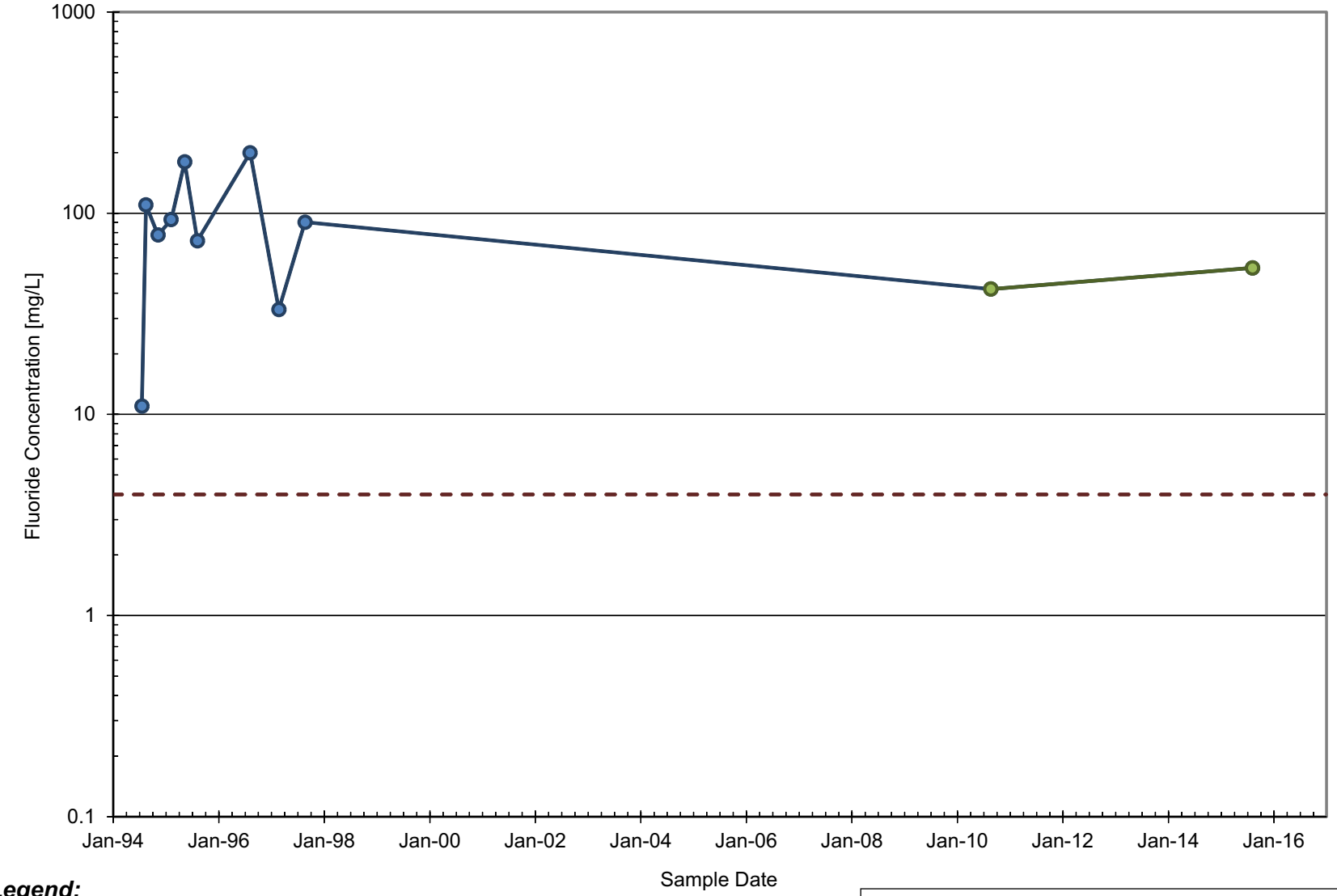
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW03-175R

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-3



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW04-019

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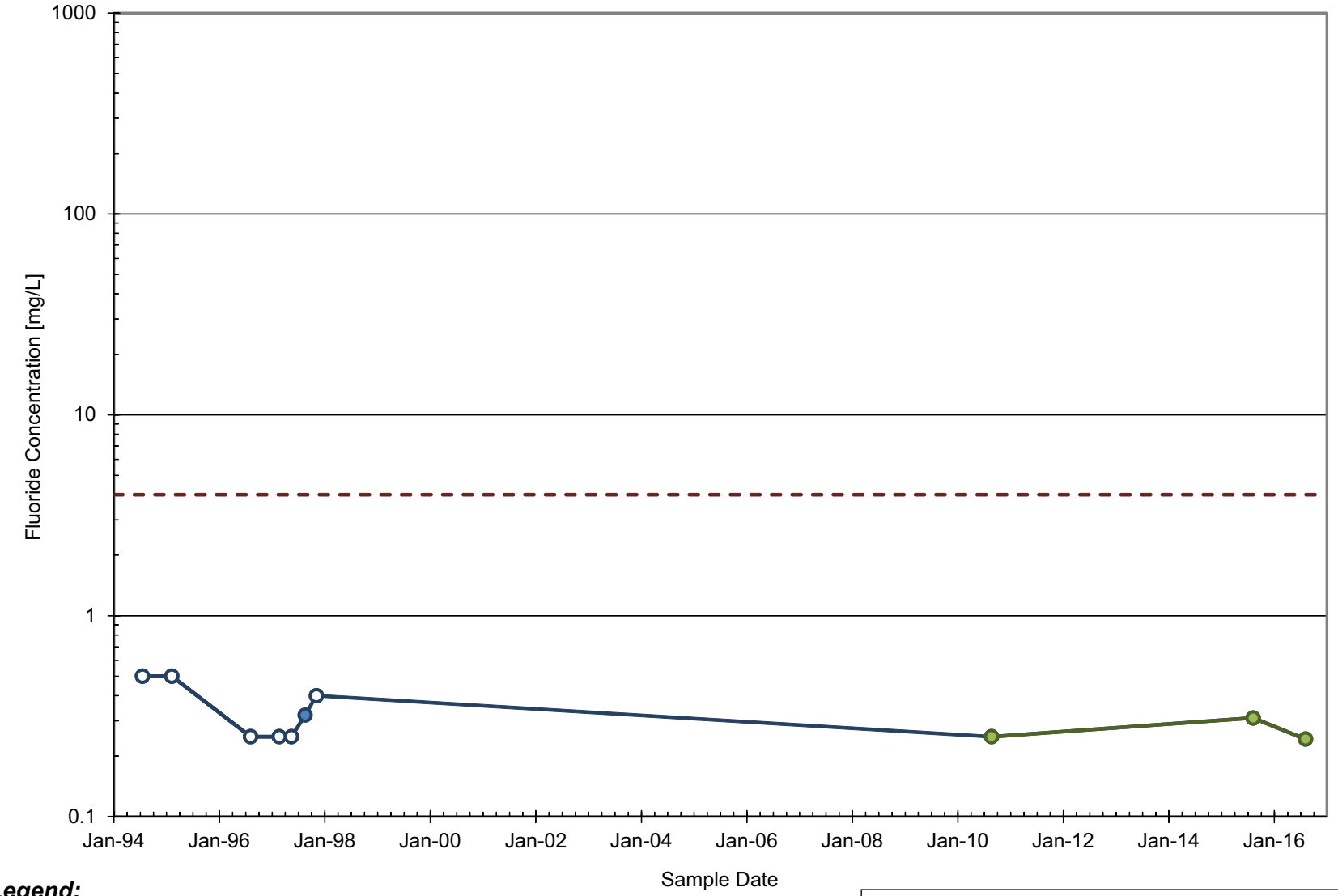
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-4



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

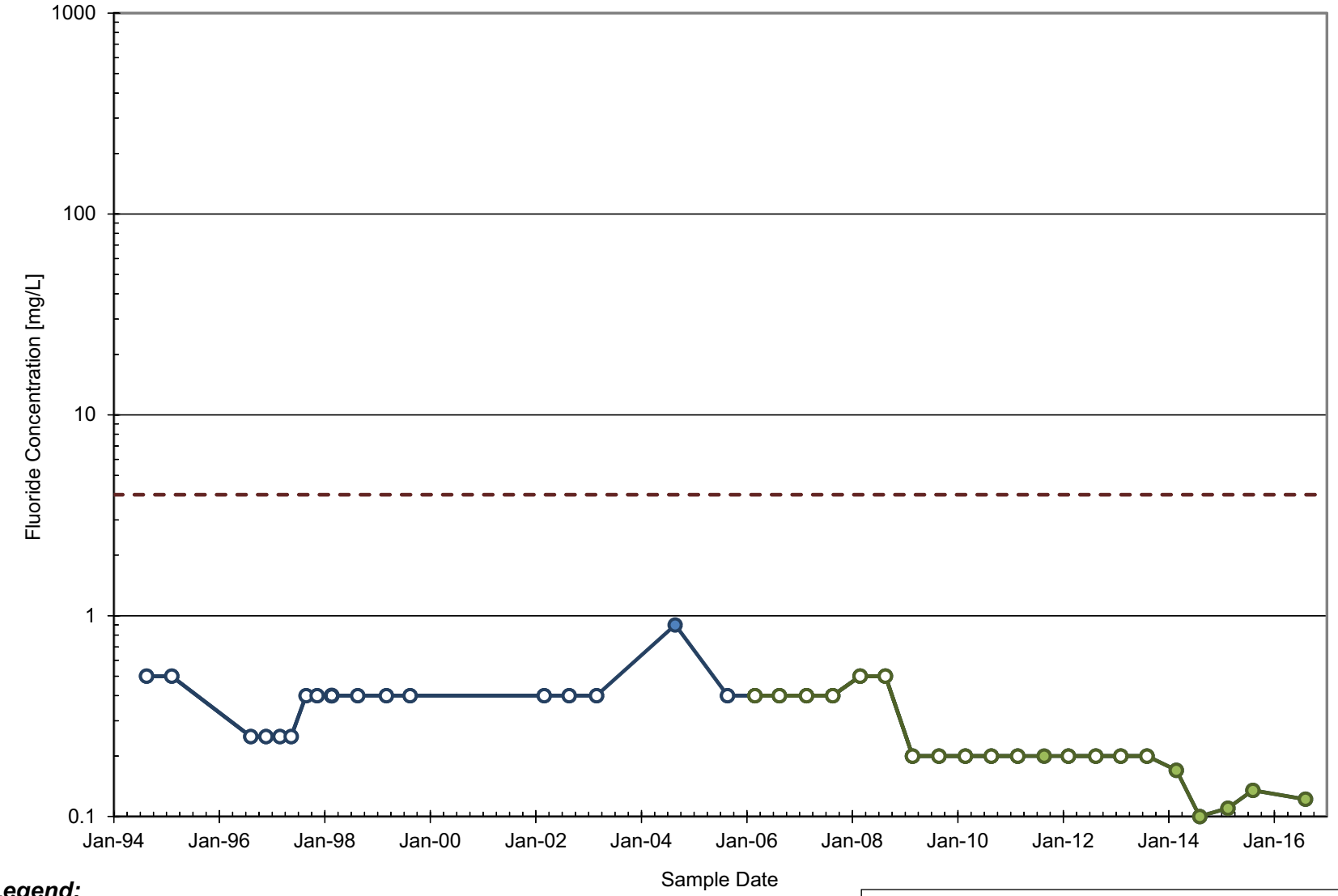
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW07-024R

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-5



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

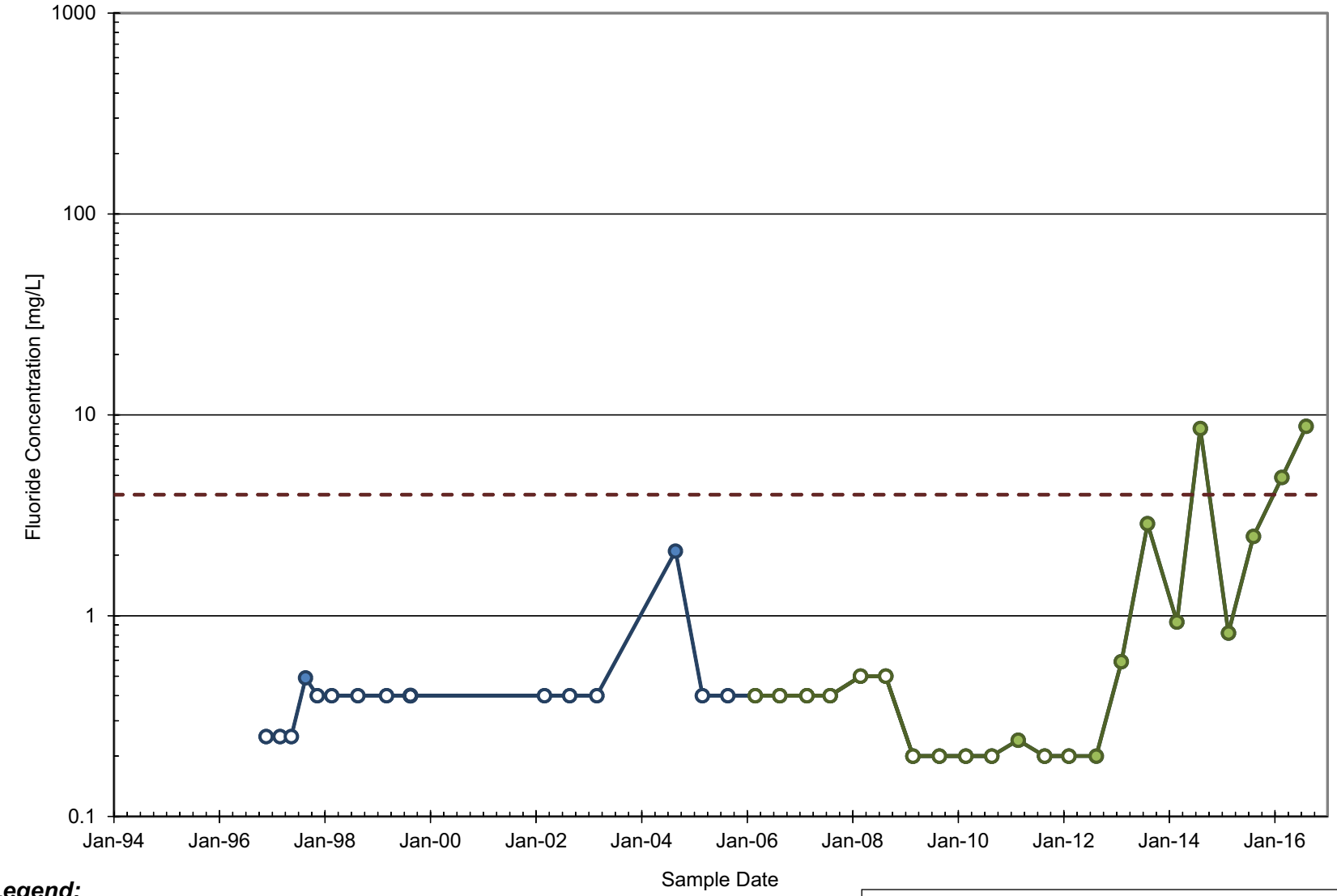
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW10-023

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-6



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW10-090

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
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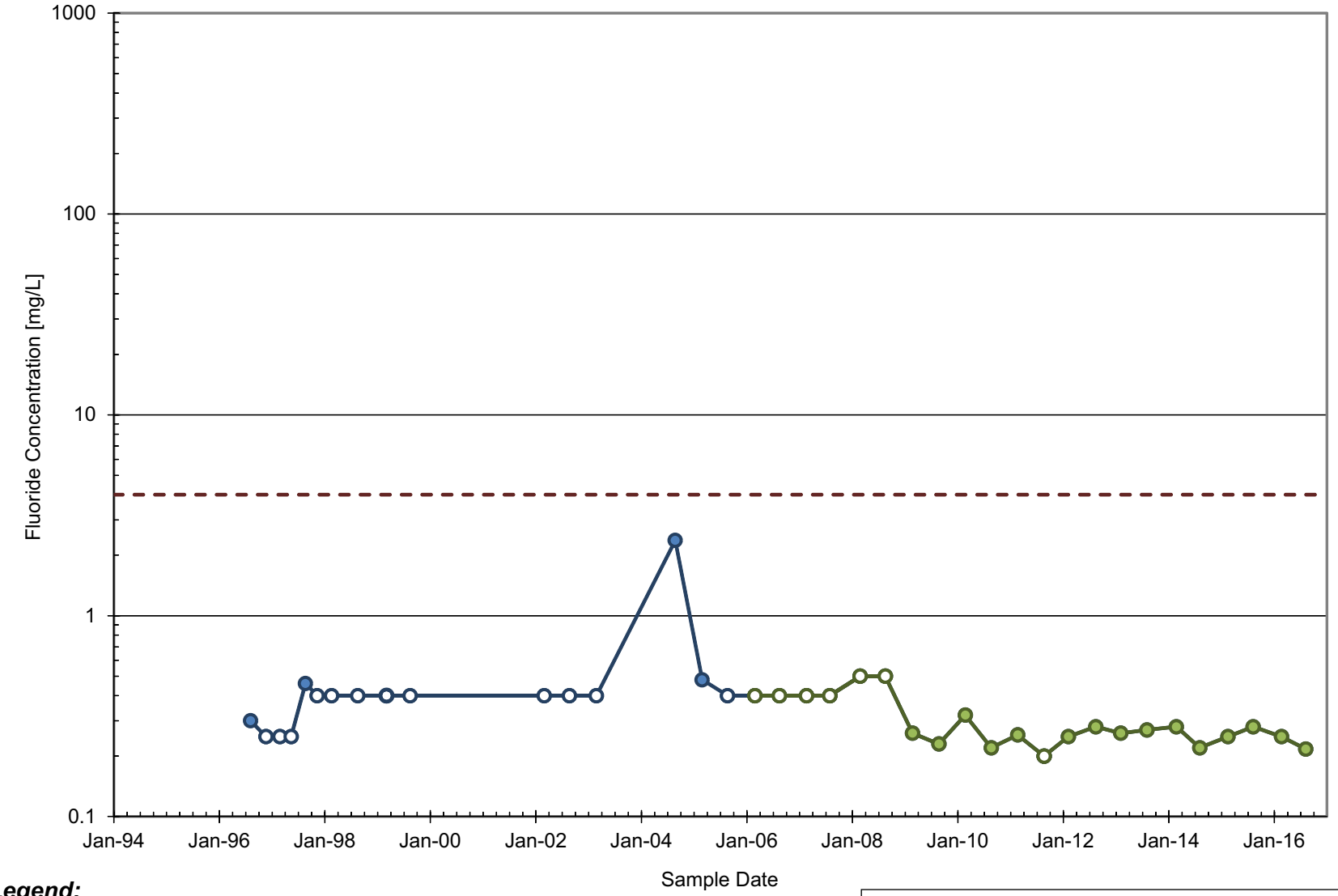
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-7



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW10-165

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Port of Portland
Troutdale, Oregon

Apex Companies, LLC
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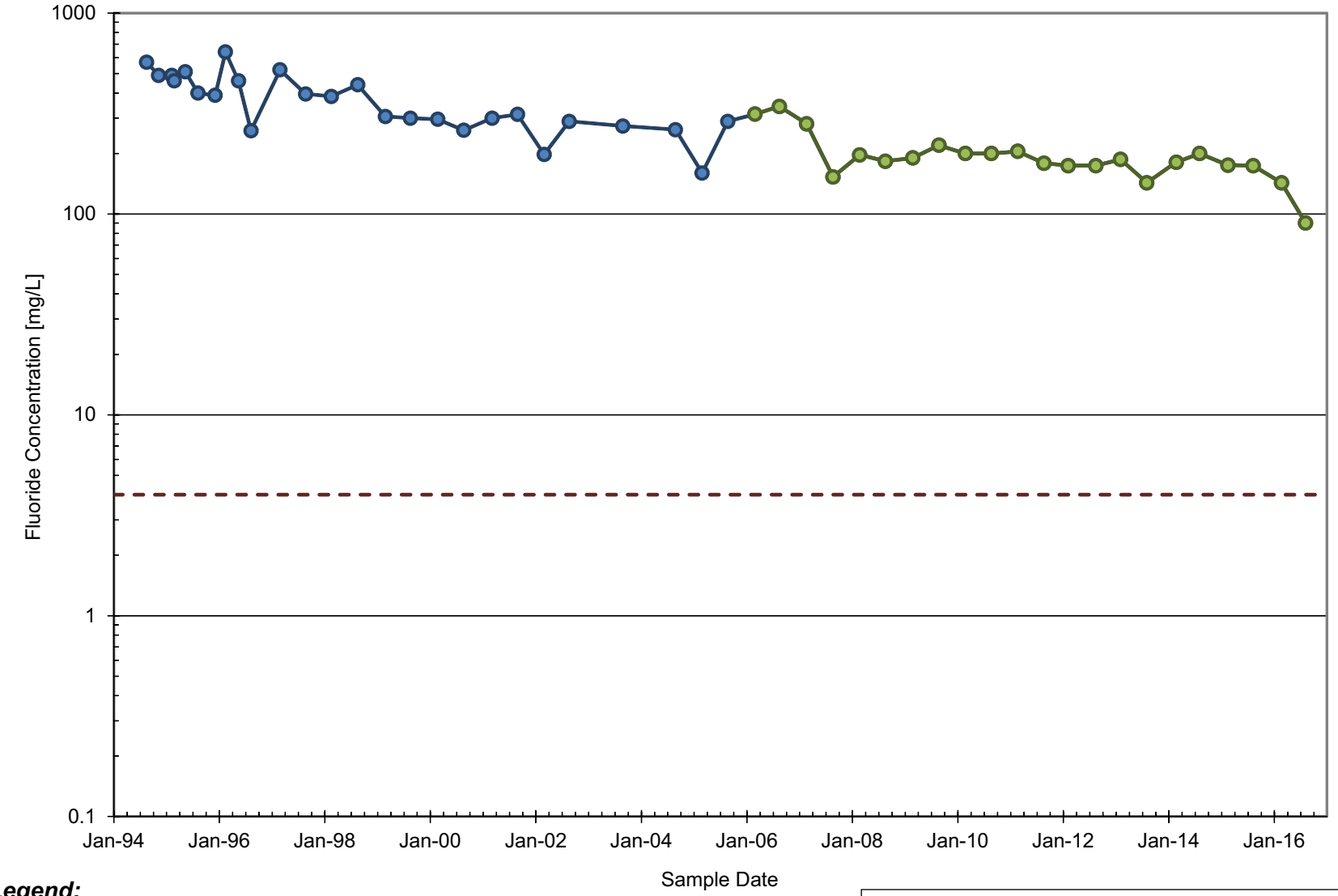
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-8



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW11-017

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Troutdale, Oregon

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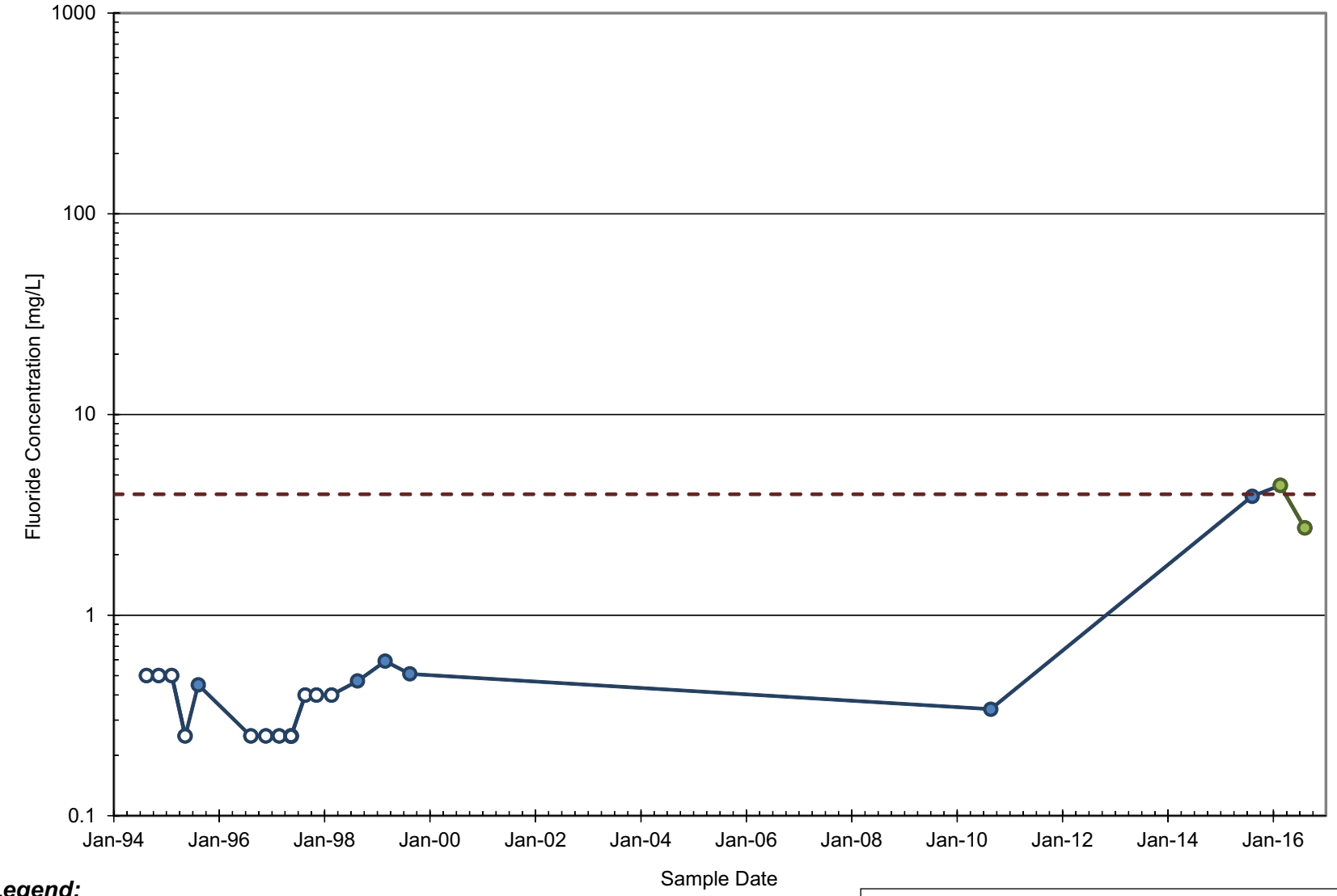
Project Number	1069-70	Figure
January 2017		B-9



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW12-021

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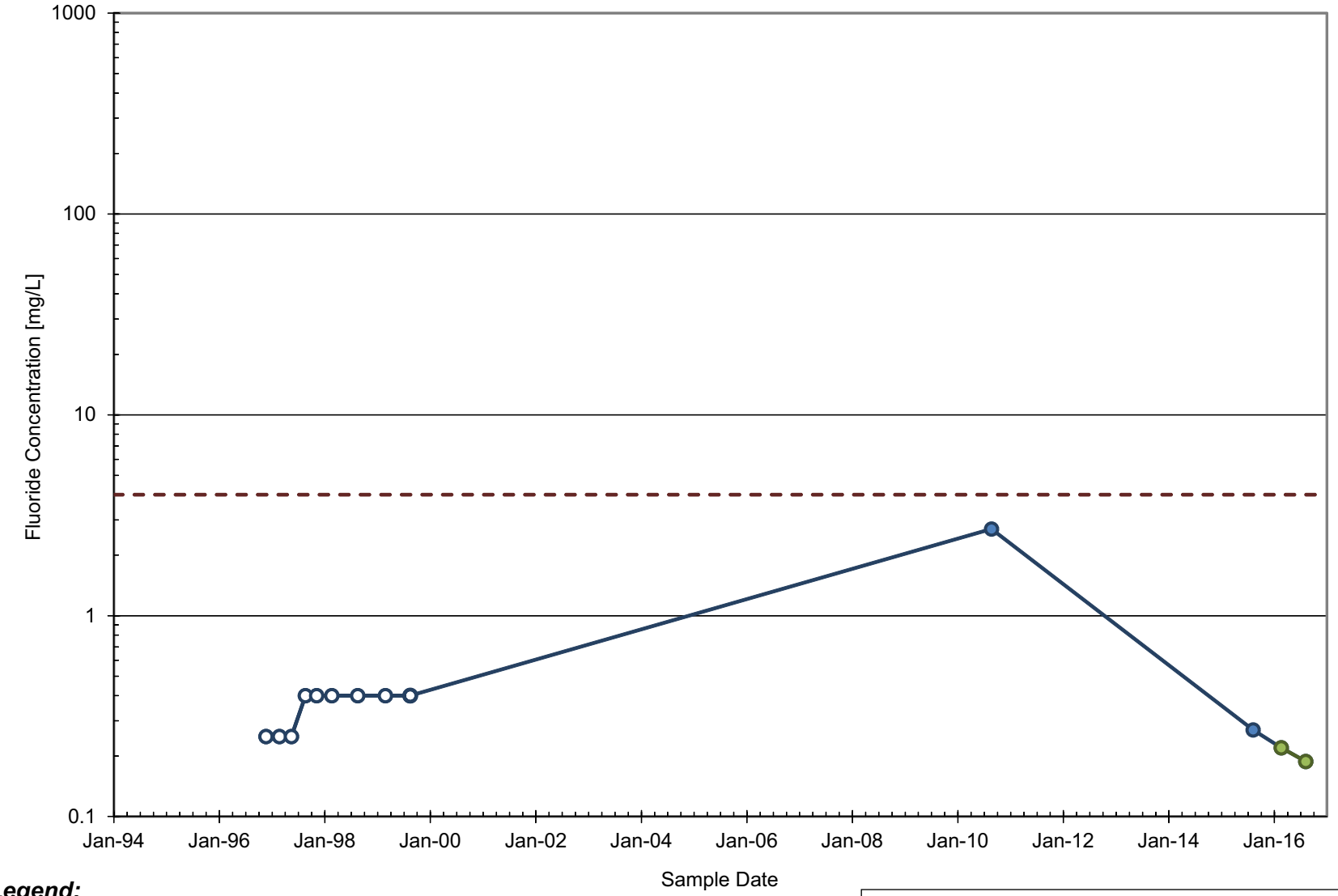
Project Number	1069-70	Figure
January 2017		B-10



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW12-092

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Troutdale, Oregon

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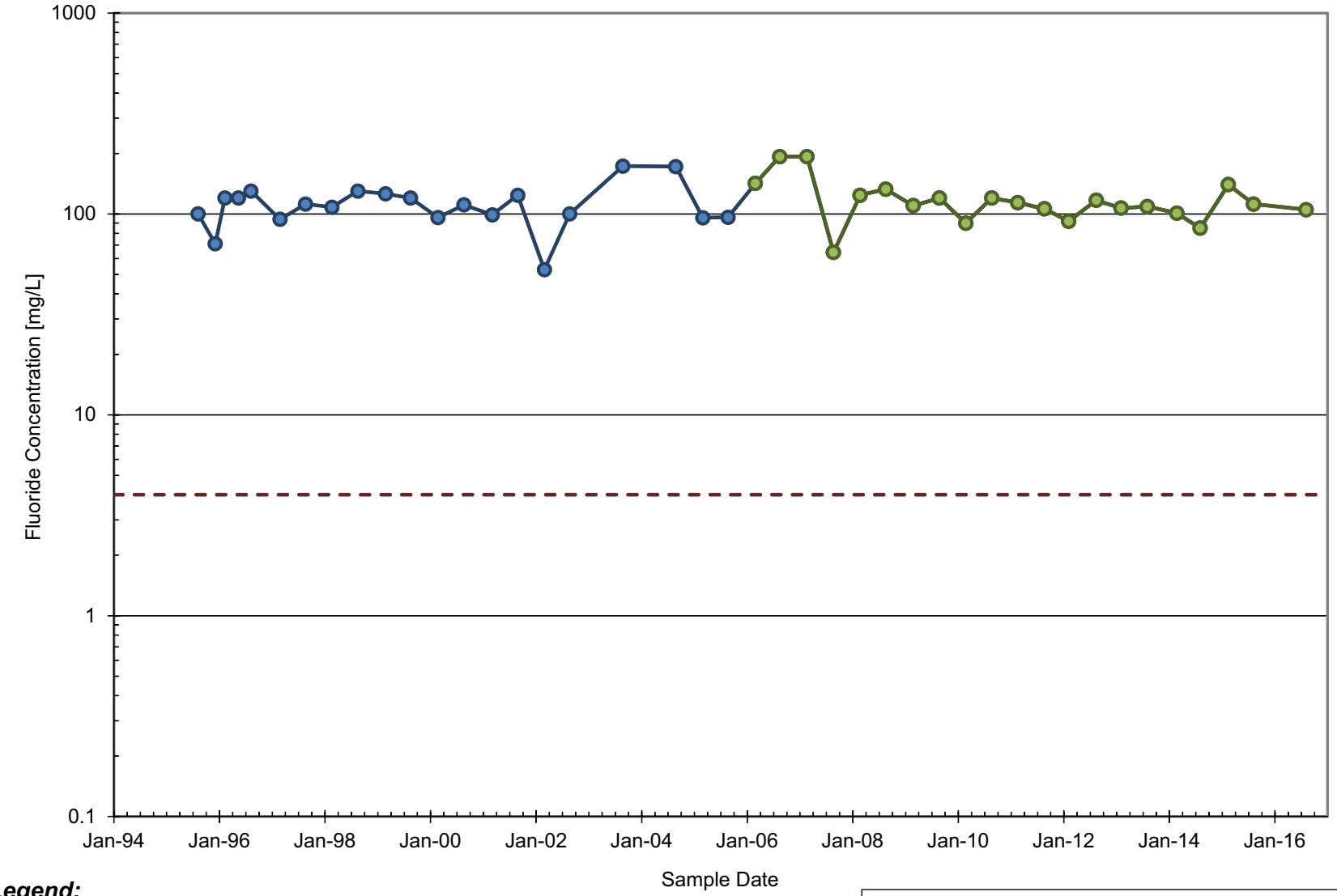
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-11



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW13-022

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Troutdale, Oregon

Apex Companies, LLC
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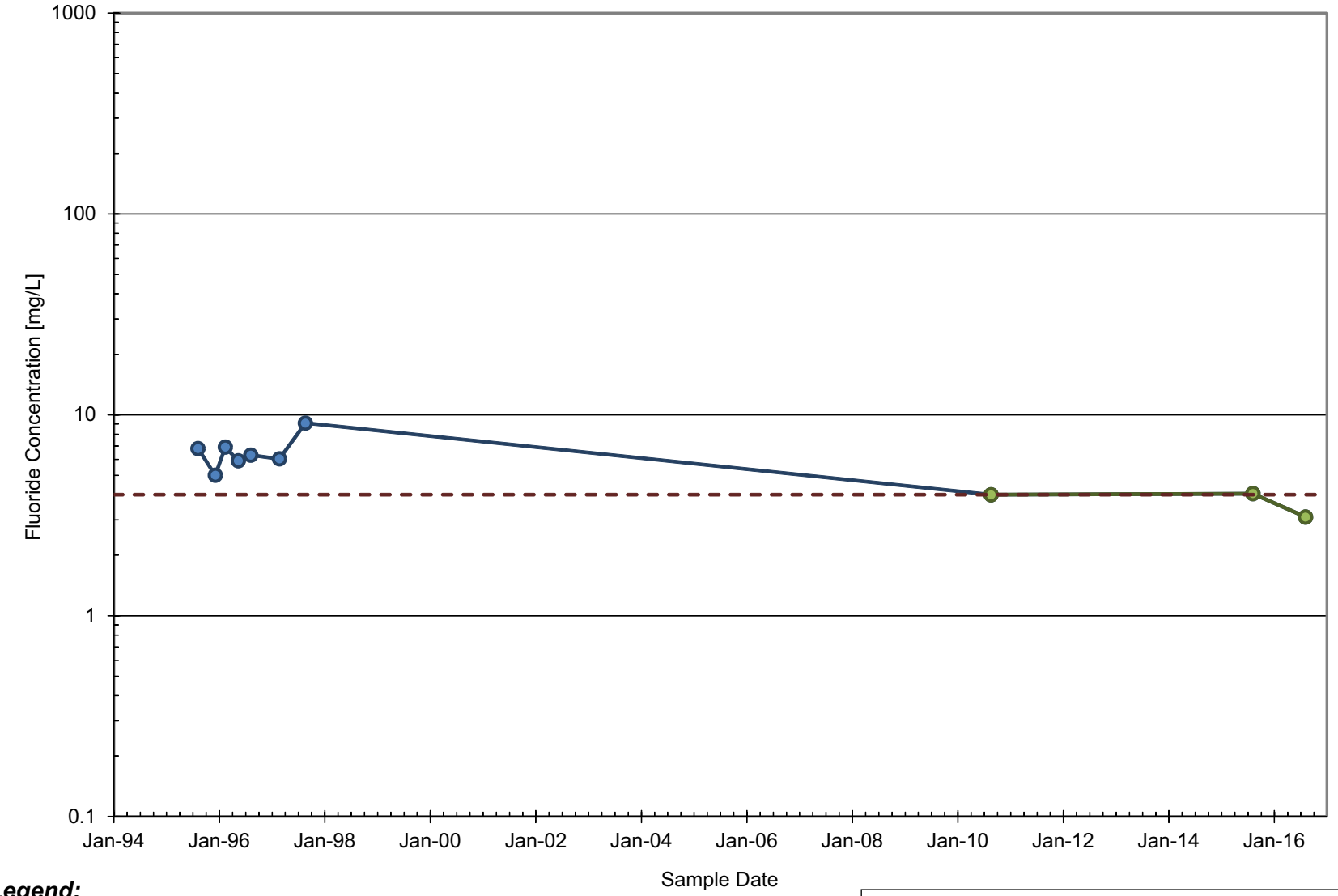
Project Number	1069-70
January 2017	

Figure B-12



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW14-015

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Troutdale, Oregon

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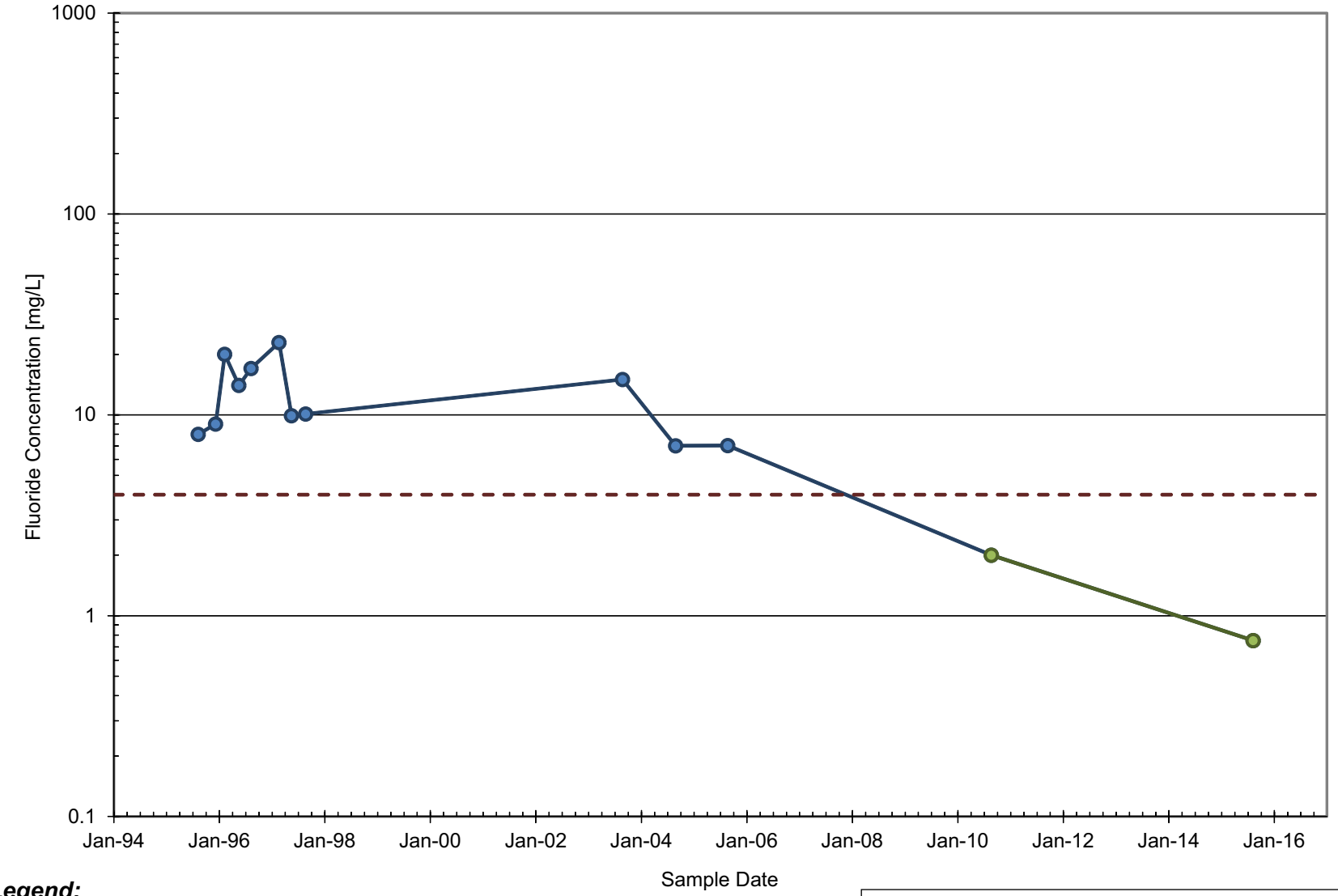
Project Number	1069-70	Figure
January 2017		B-13



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW16-014

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Troutdale, Oregon

Apex Companies, LLC
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Project Number	1069-70
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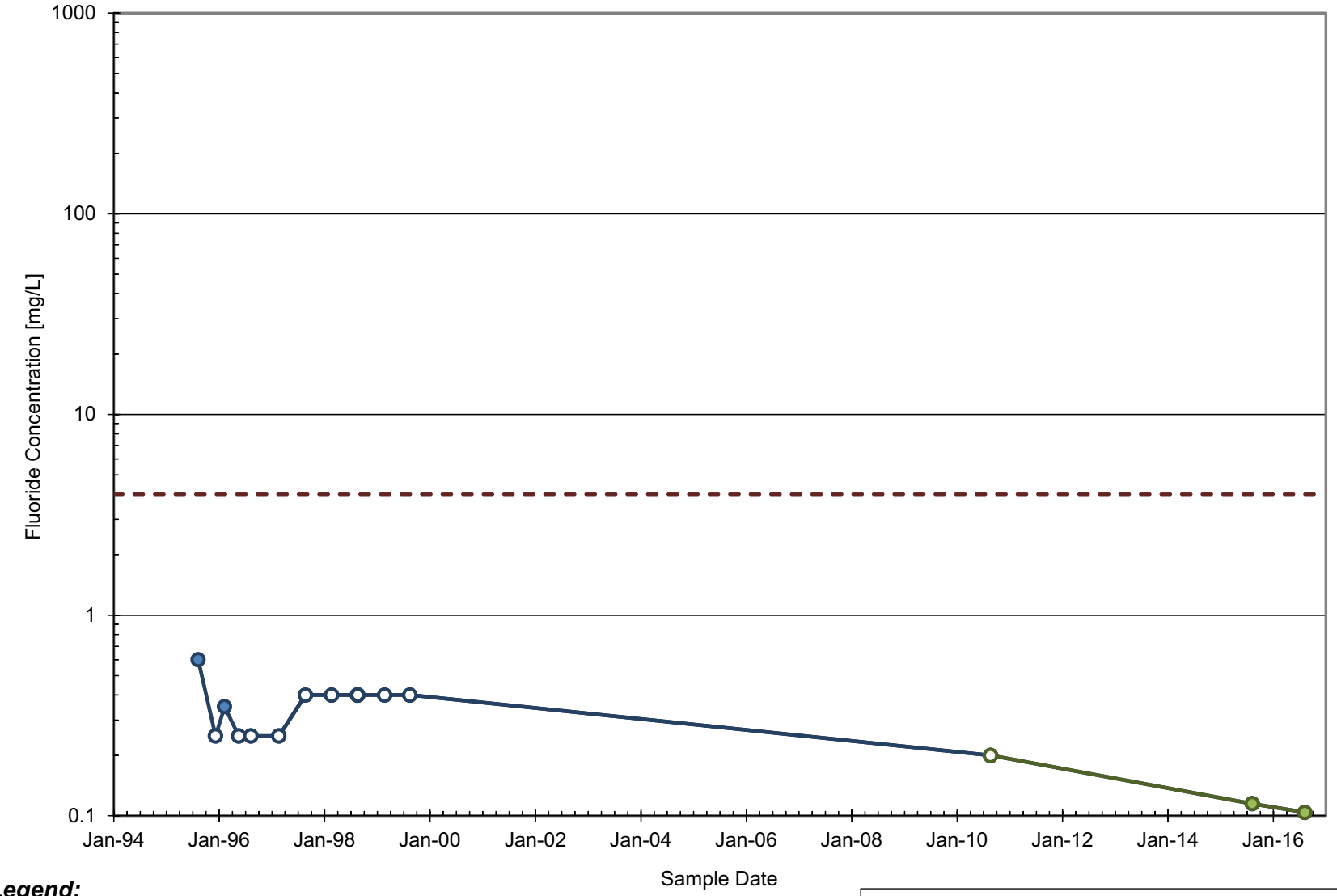

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW 17-028

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Troutdale, Oregon

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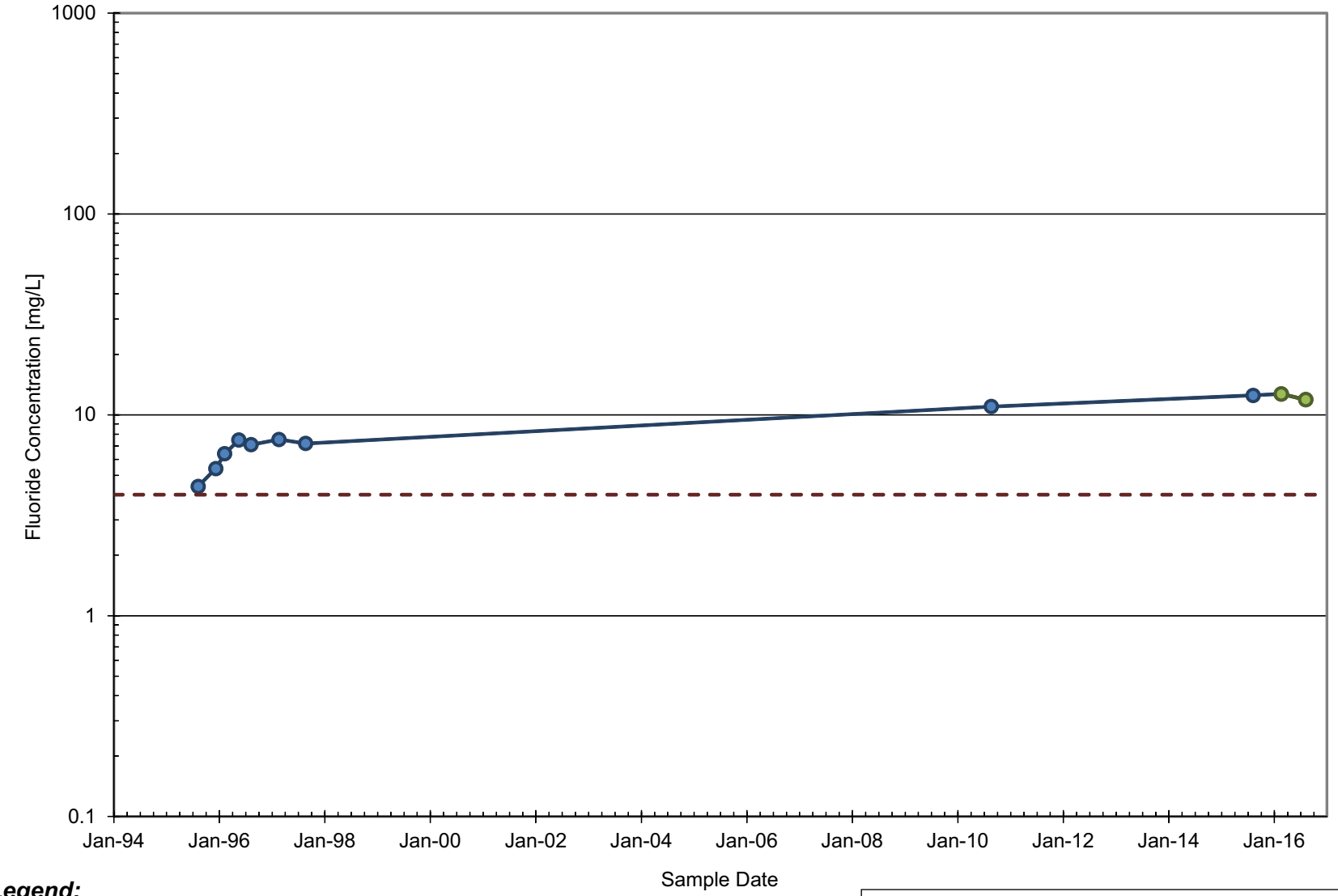
Project Number	1069-70	Figure
January 2017		B-15



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW18-016

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Troutdale, Oregon

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Project Number	1069-70
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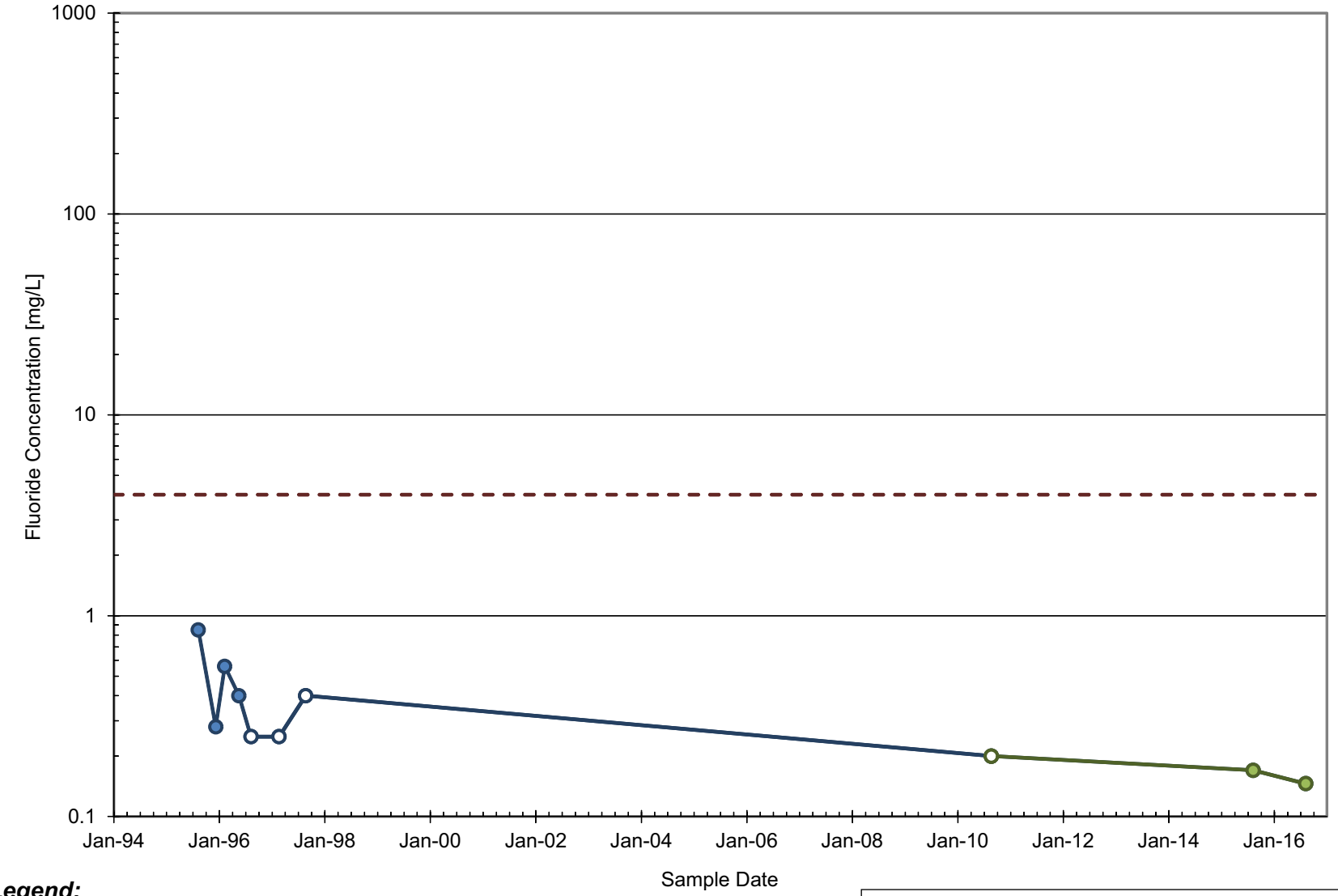

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW18-031

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Project Number	1069-70	Figure
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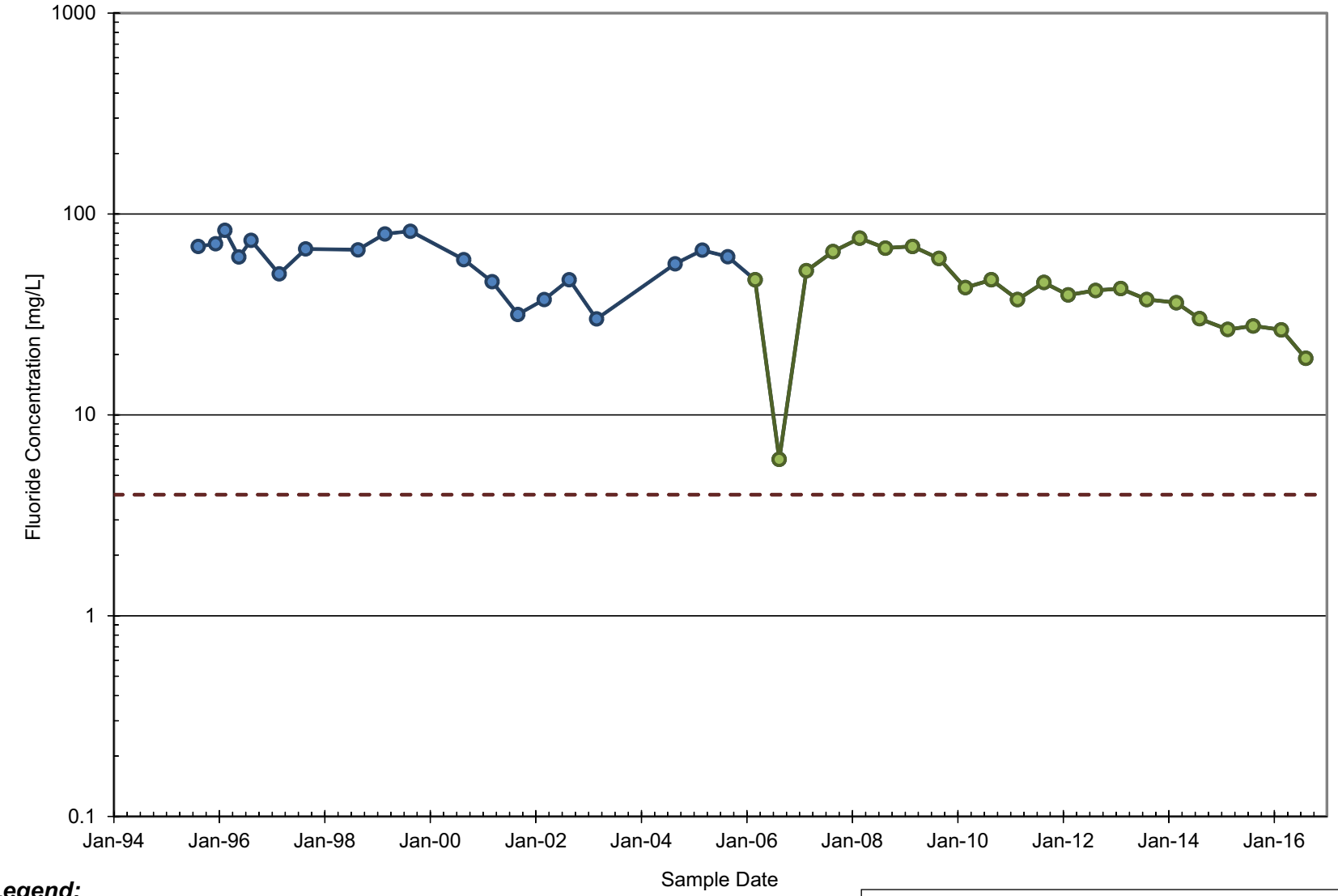

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW 19-013

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Troutdale, Oregon

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January 2017	

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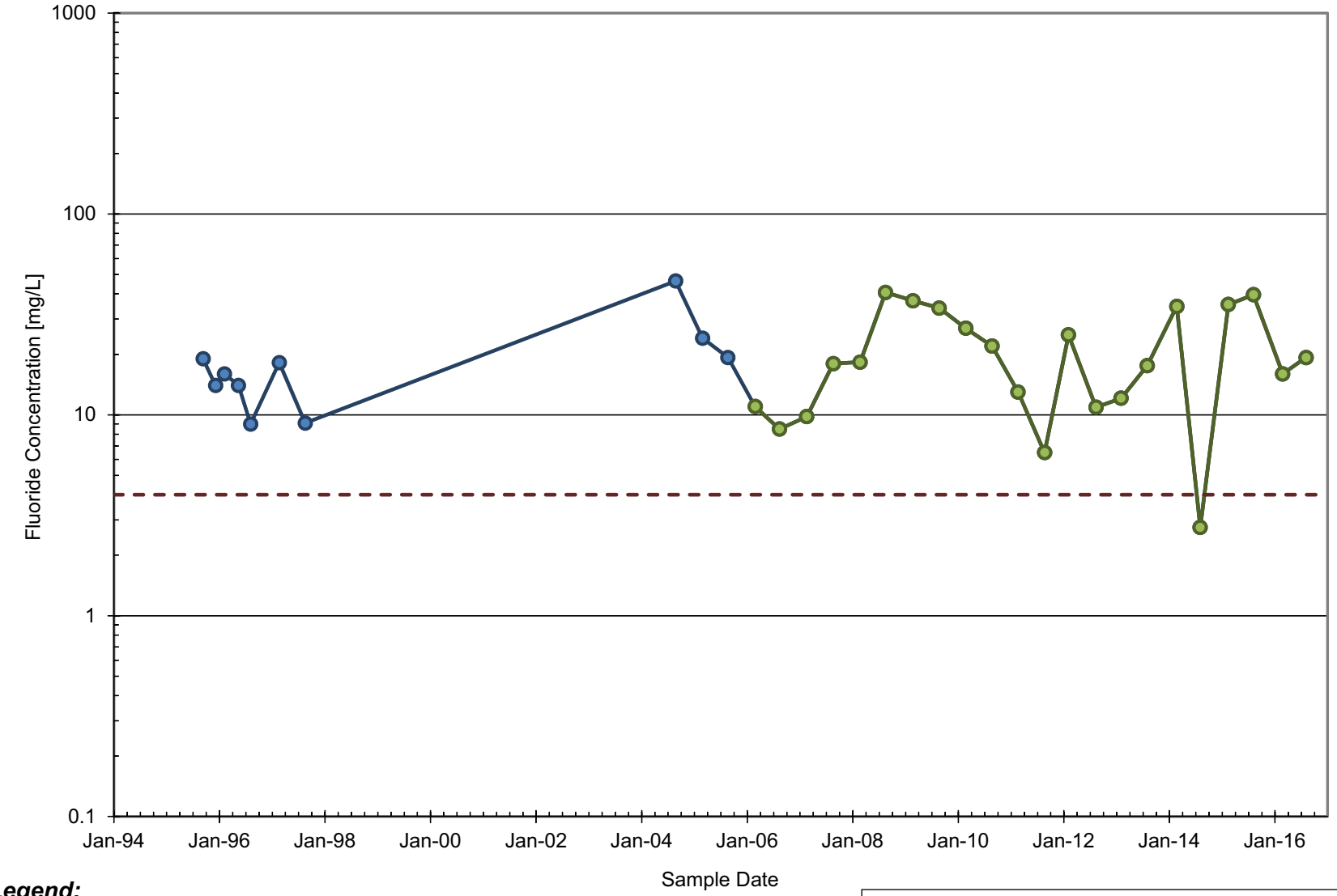

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW23-025

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Troutdale, Oregon

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Project Number	1069-70	Figure
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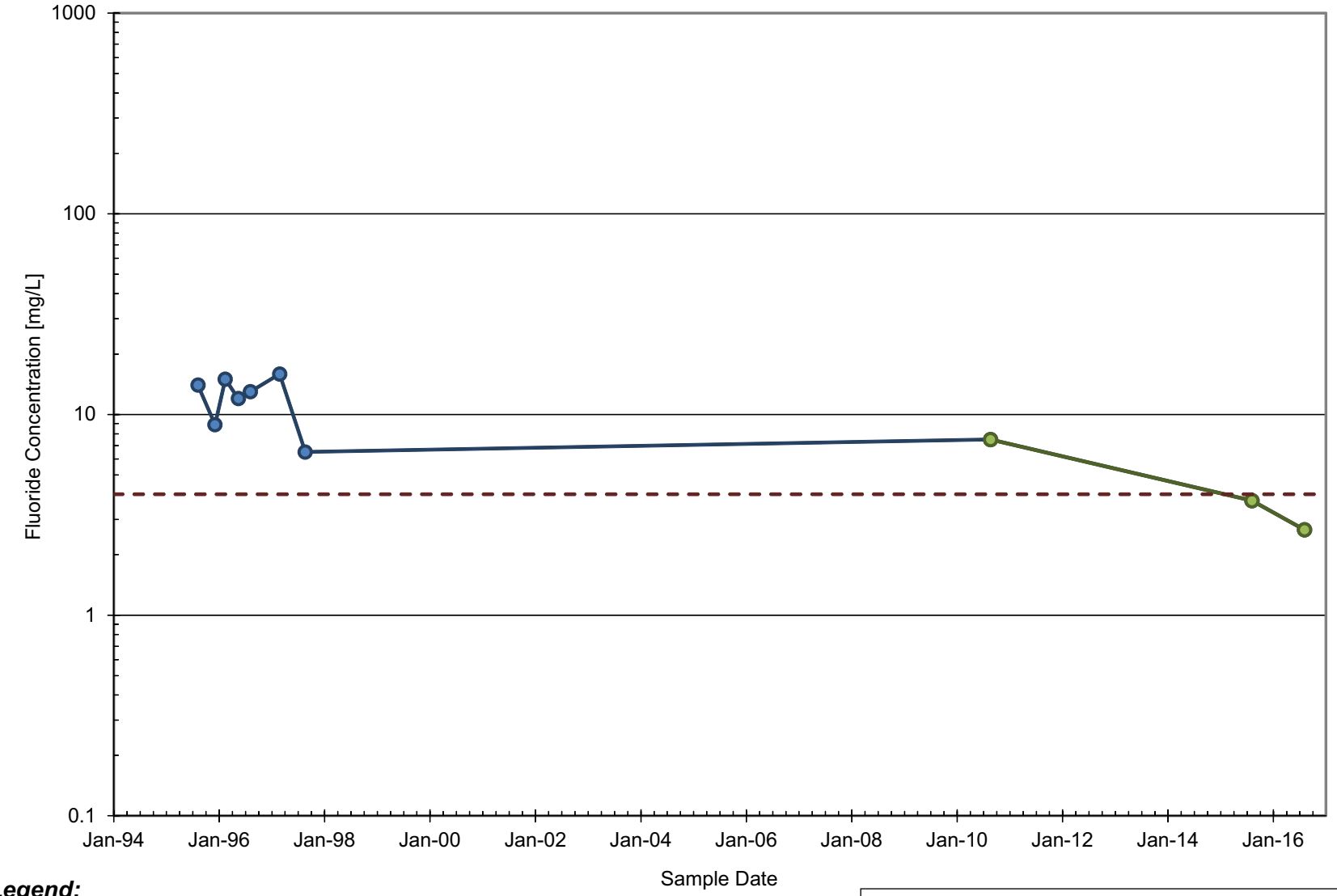

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW24-010

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Troutdale, Oregon

Apex Companies, LLC
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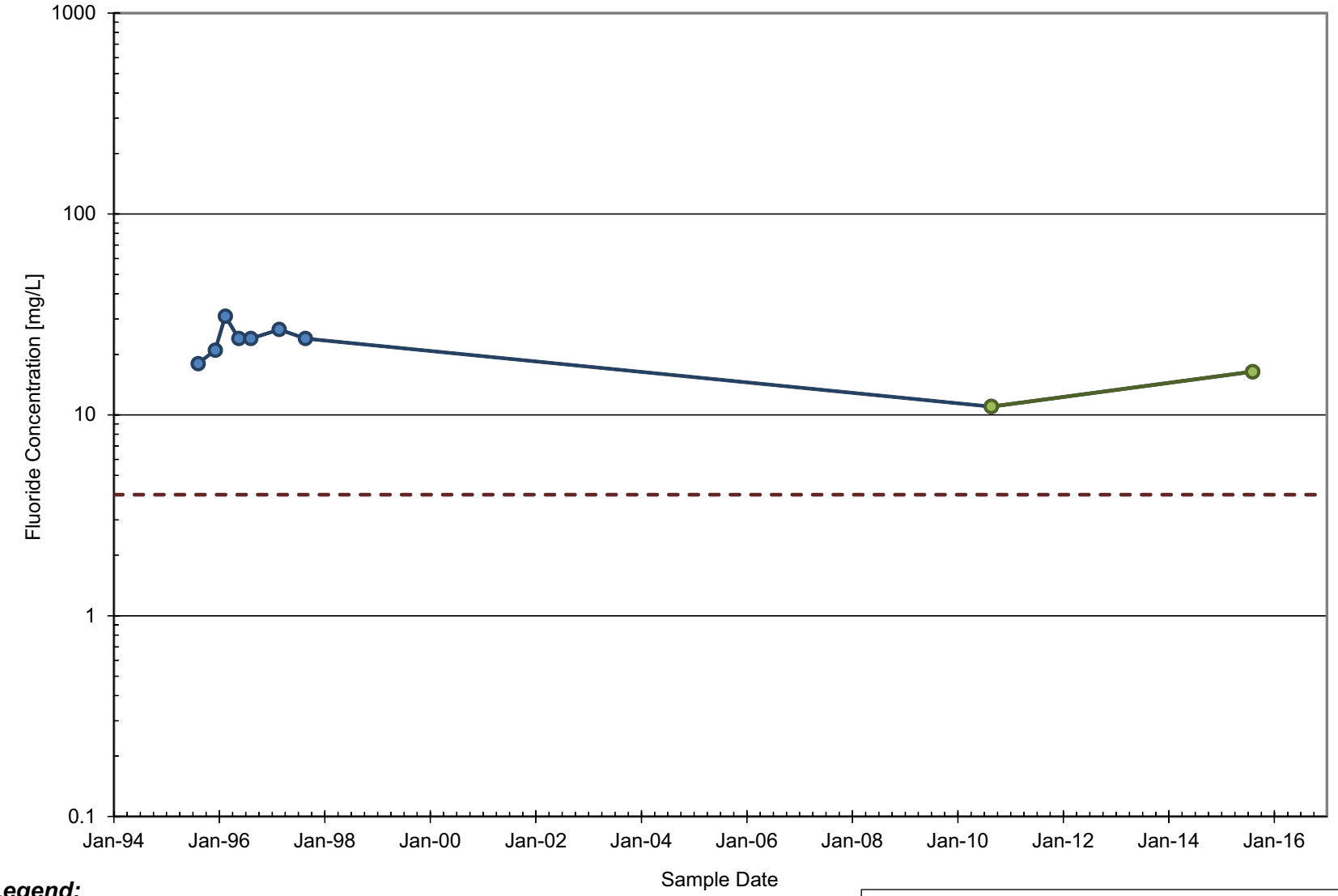
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-20



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW25-024

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Port of Portland
Troutdale, Oregon

Apex Companies, LLC
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Portland, Oregon 97201

Project Number	1069-70	Figure
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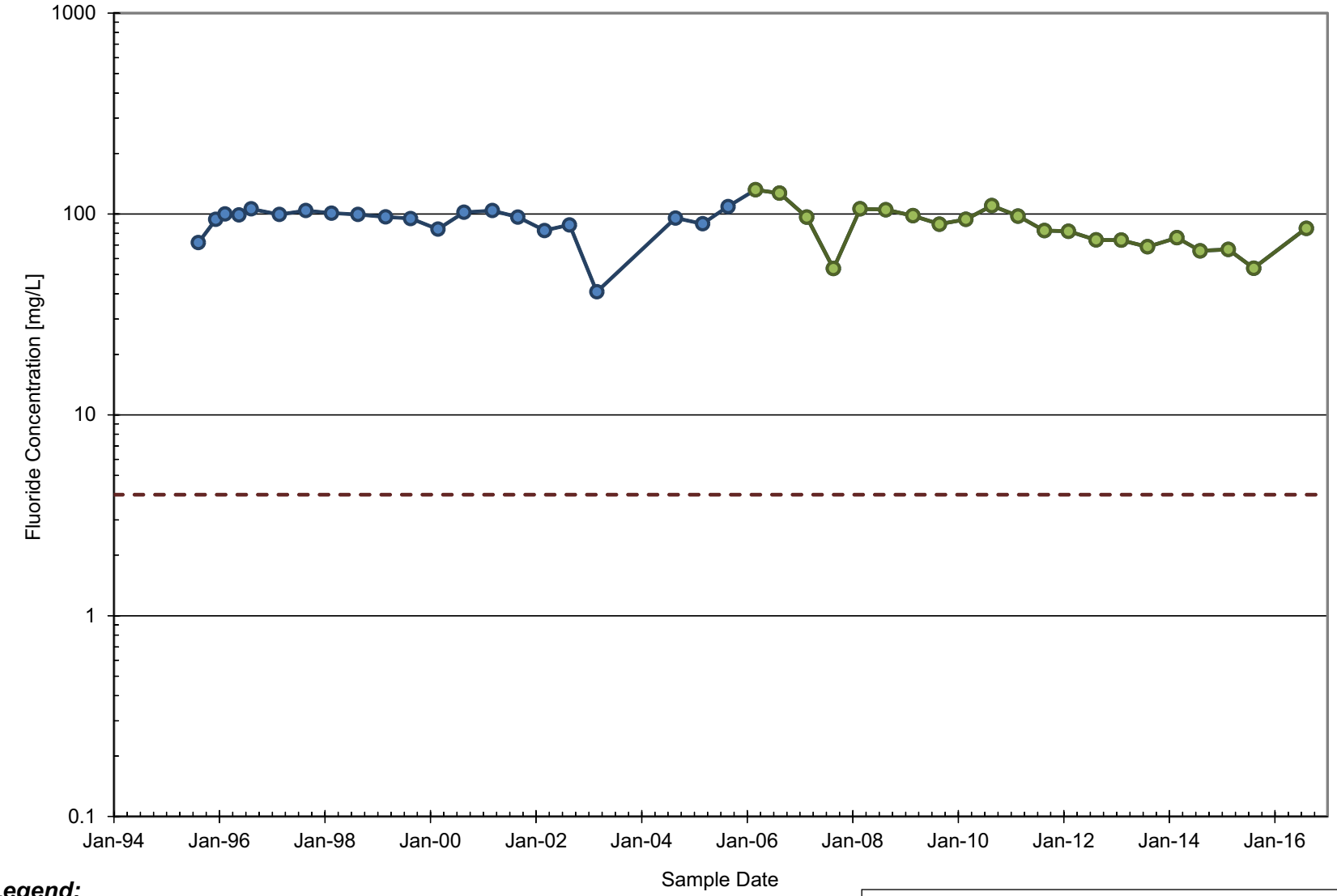

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW26-012

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Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
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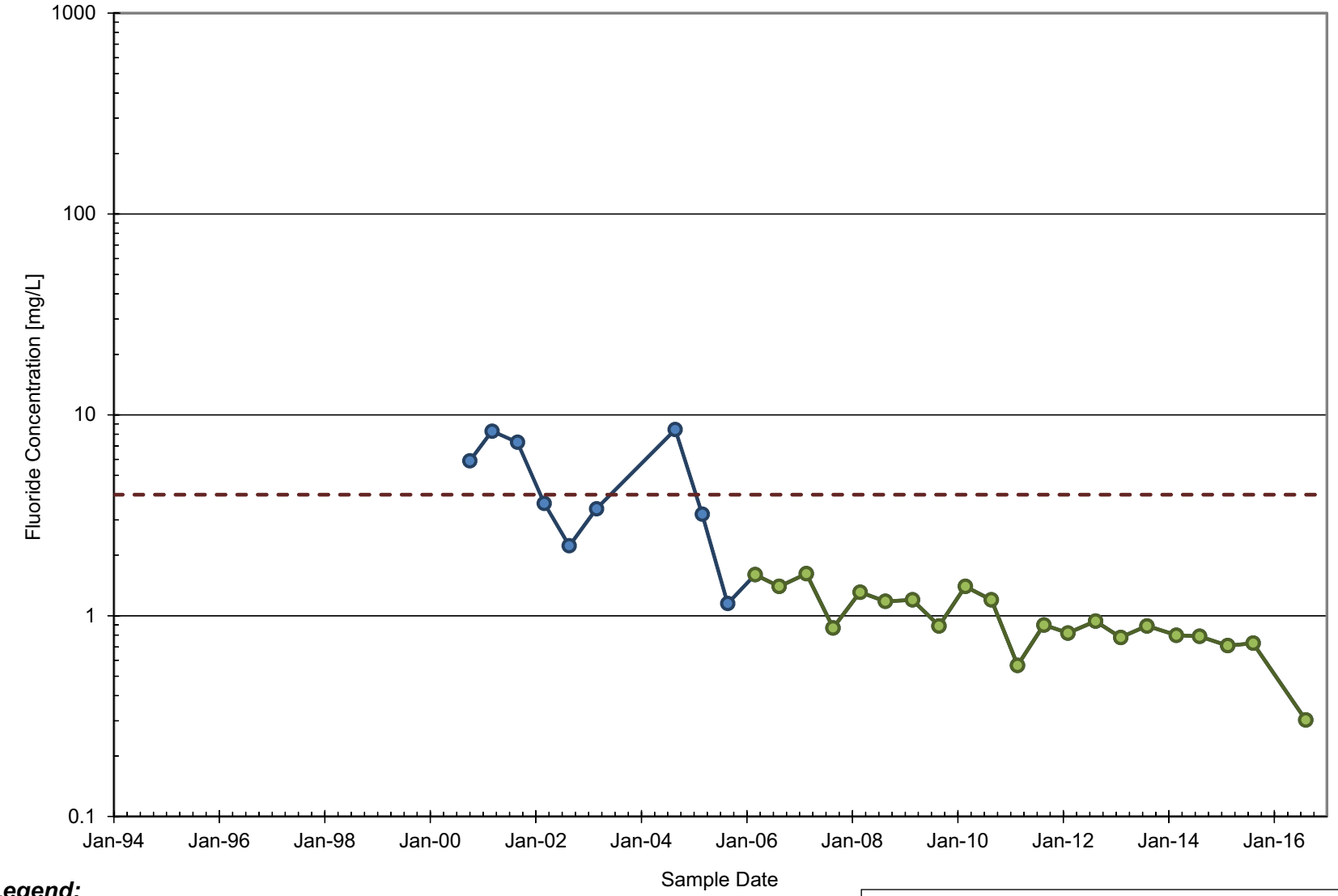

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW26-050

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Port of Portland
Troutdale, Oregon

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Project Number	1069-70	Figure
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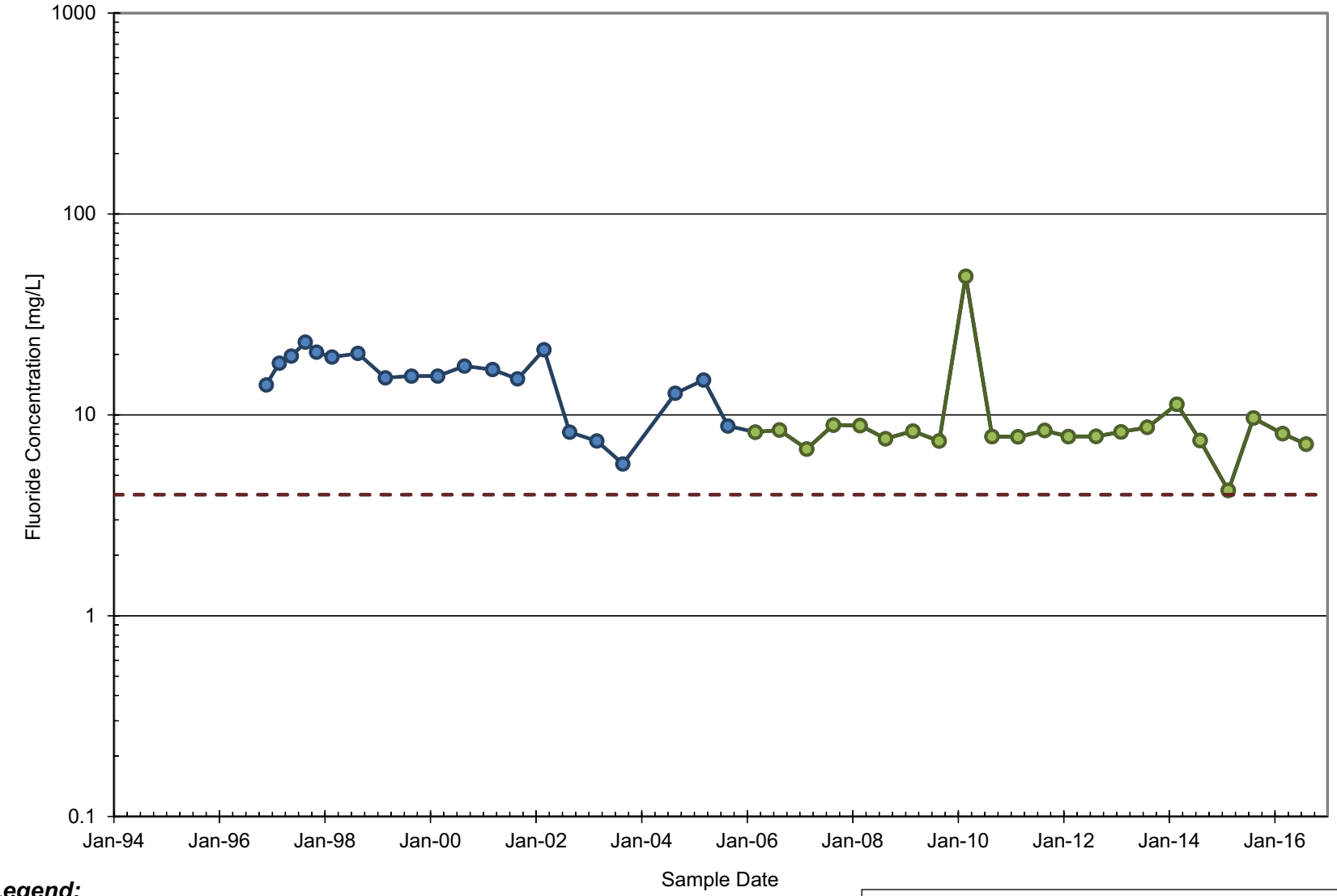

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW27-045

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Troutdale, Oregon

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Project Number	1069-70	Figure
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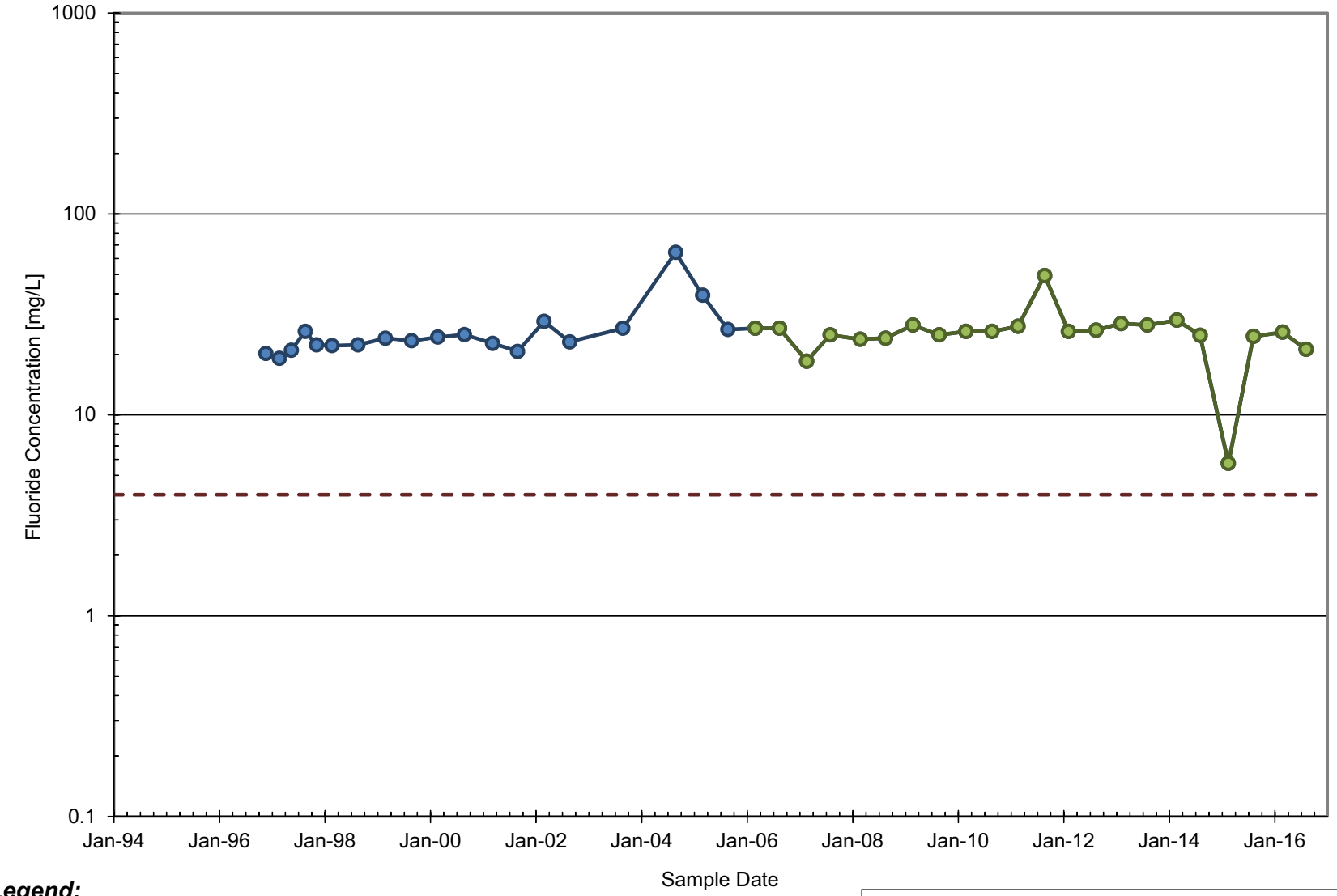

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW27-081

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Apex Companies, LLC
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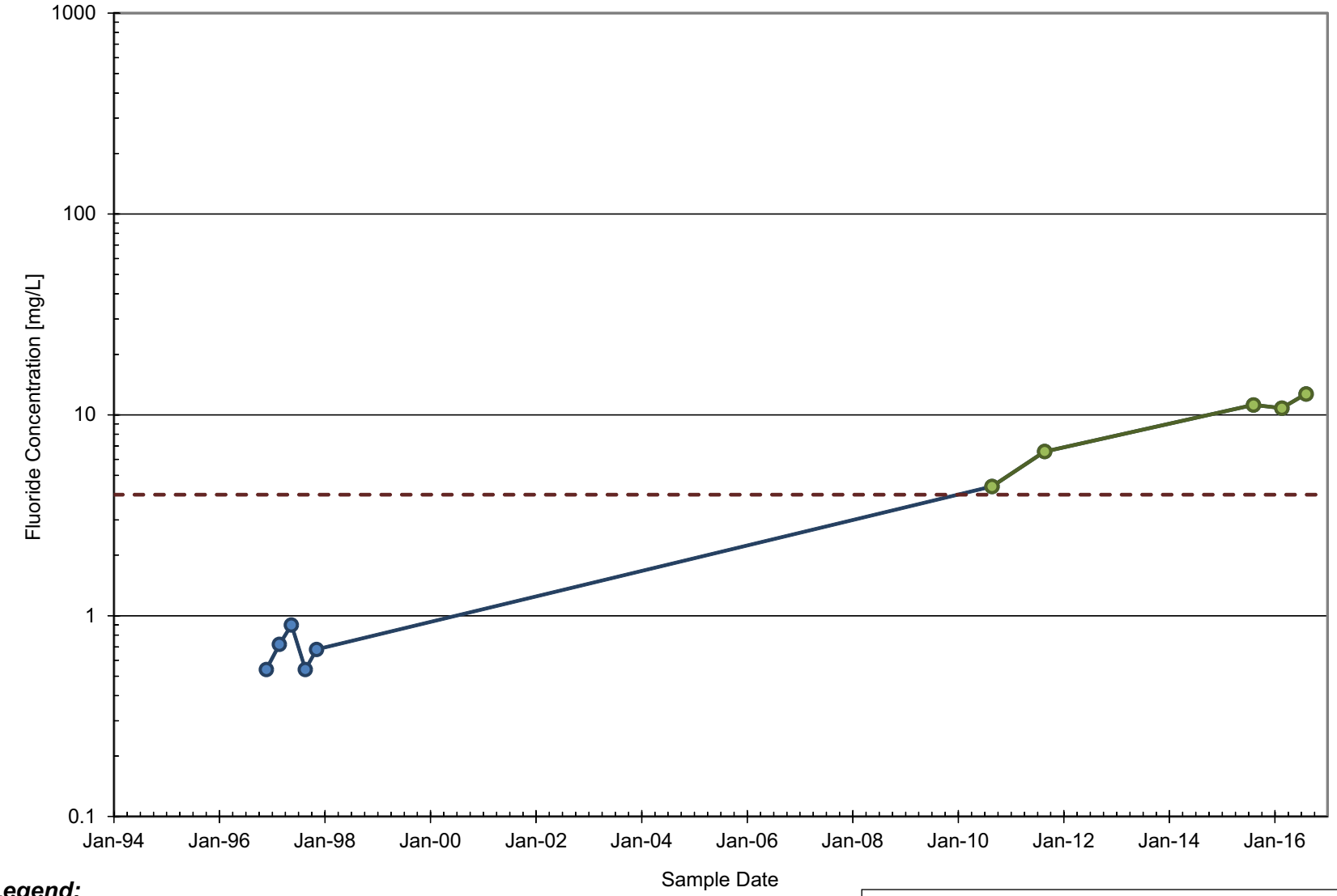
Project Number	1069-70	Figure
January 2017		B-25



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW29-033

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Troutdale, Oregon

Apex Companies, LLC
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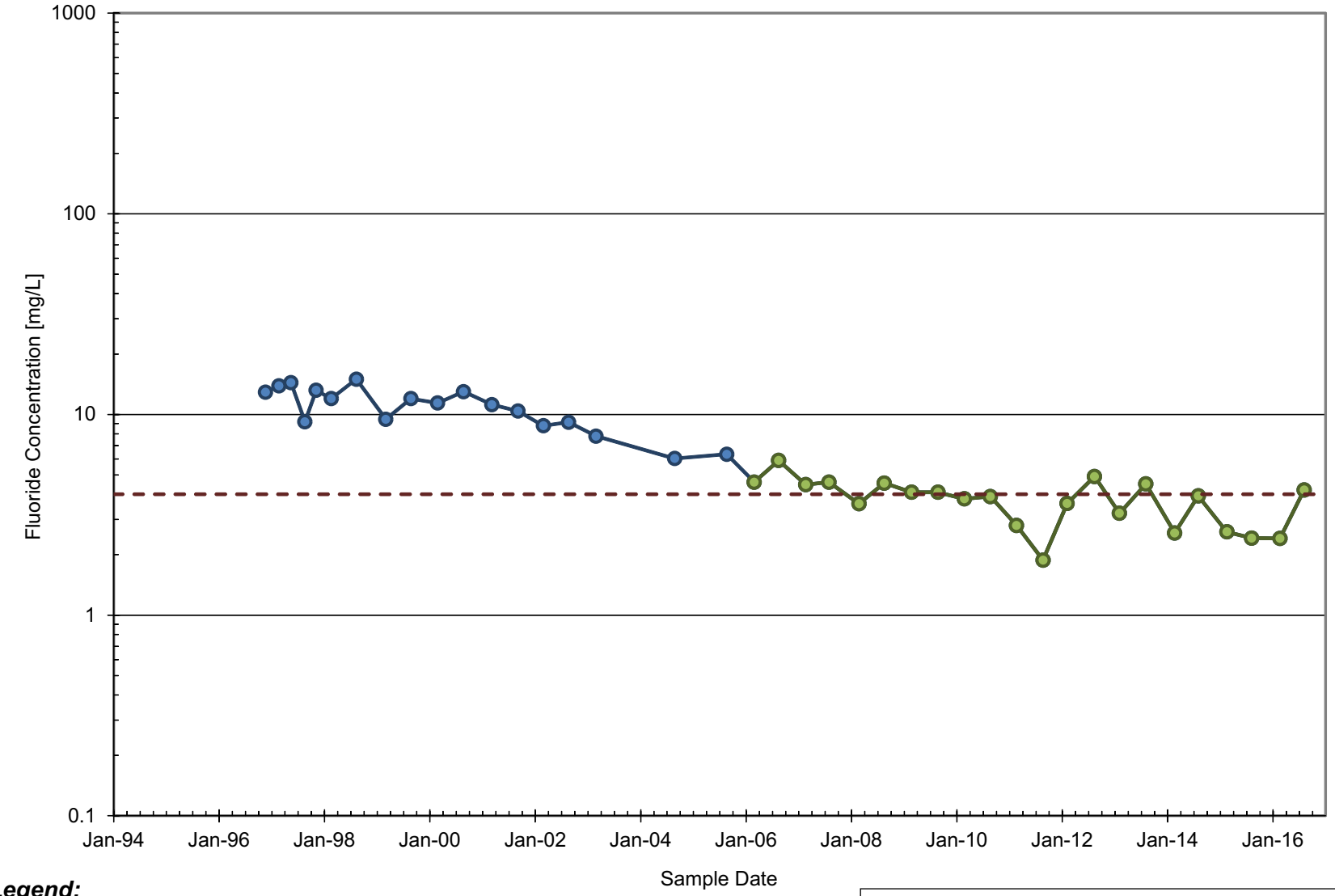
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-26



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW29-090

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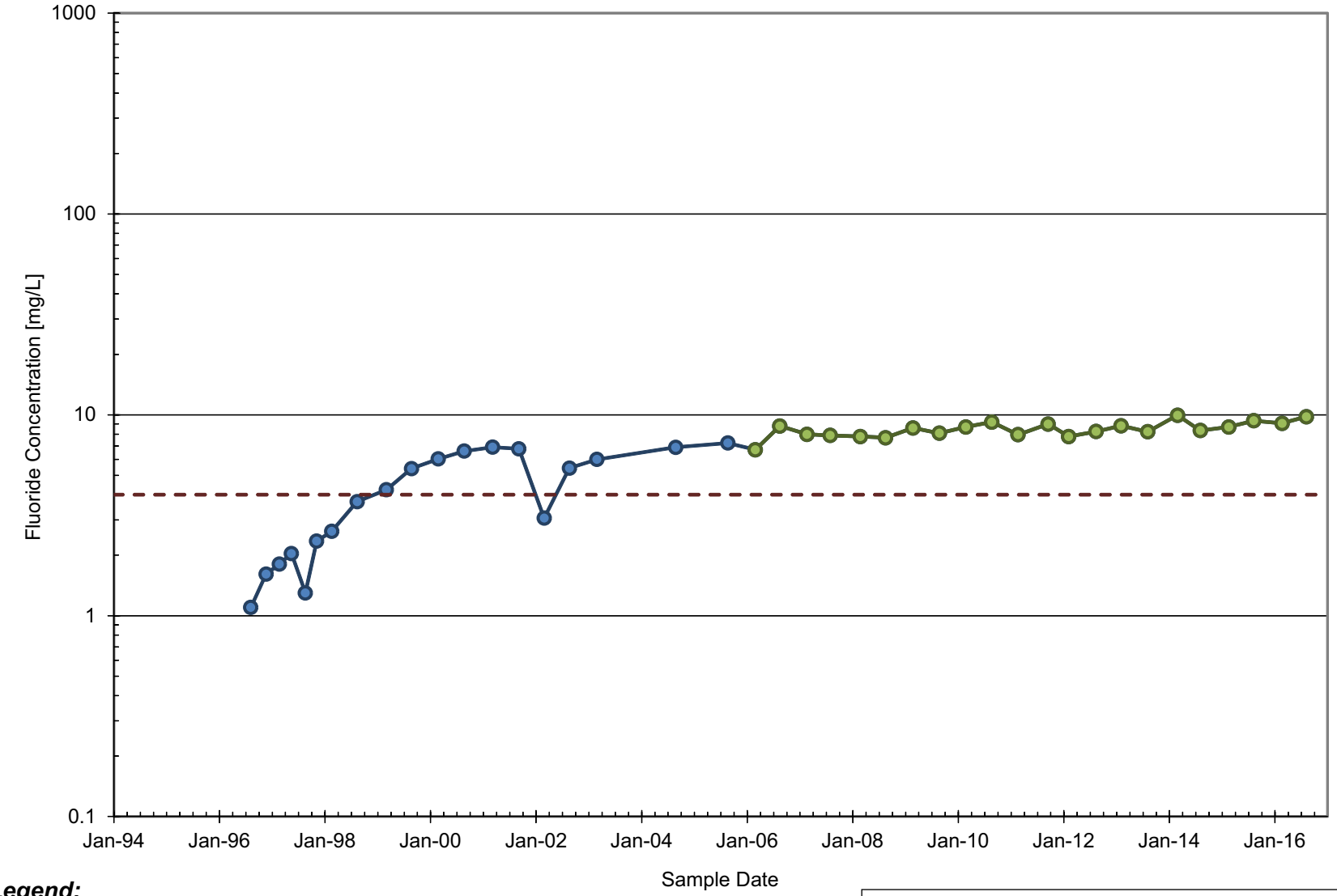
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-27



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW29-179

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Troutdale, Oregon

Apex Companies, LLC
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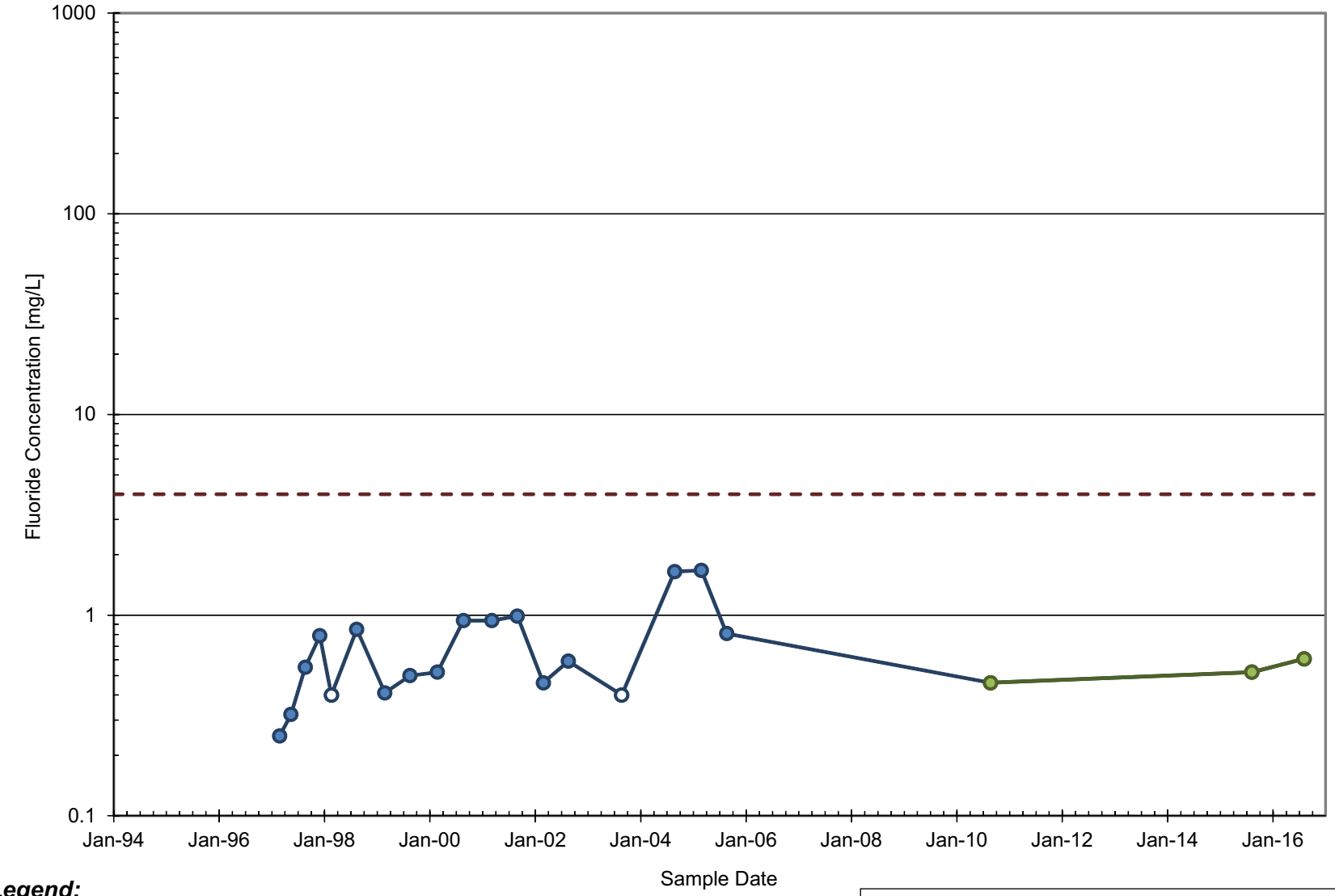
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-28



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW30-030

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Apex Companies, LLC
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Project Number	1069-70	Figure
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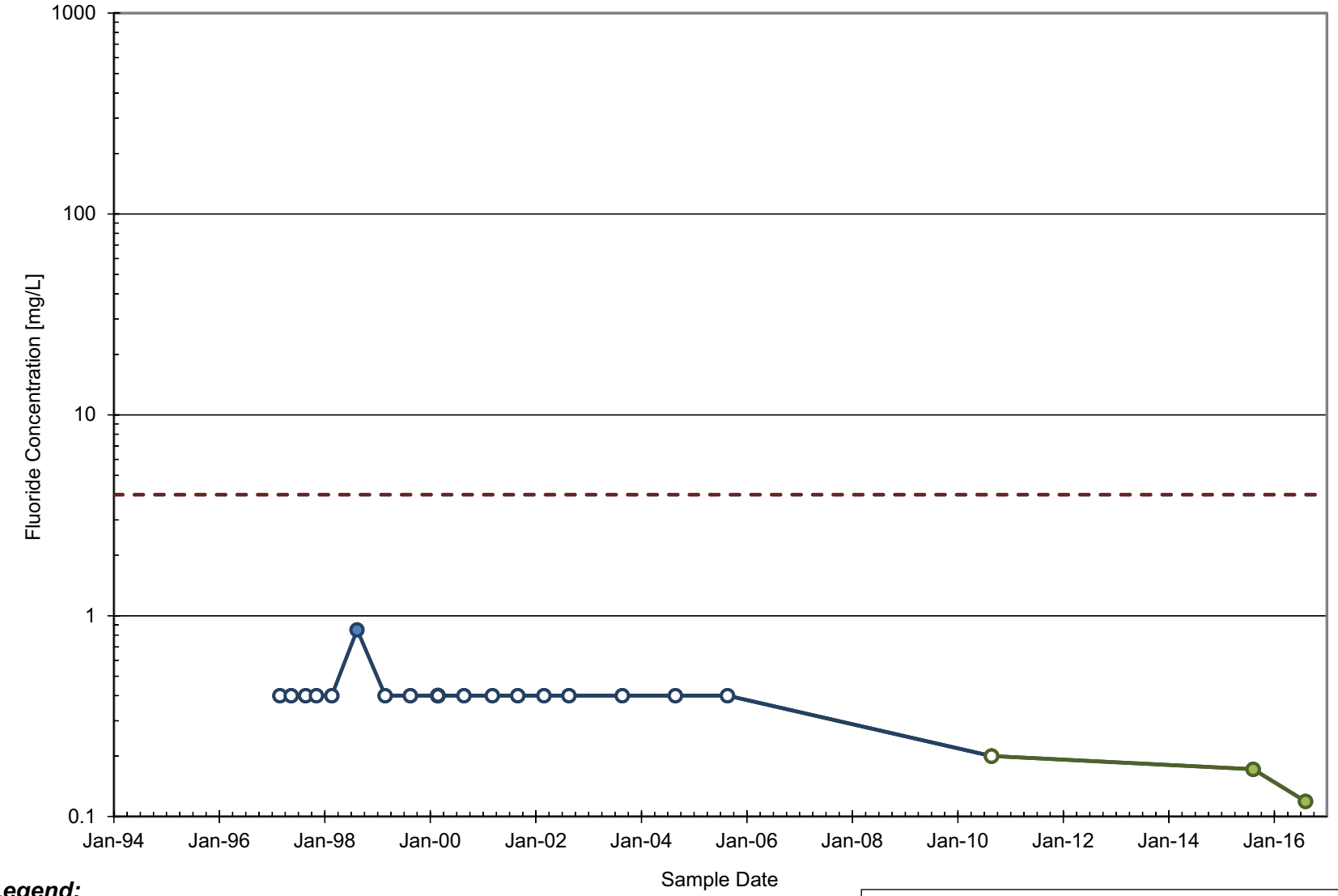

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW30-100

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Troutdale, Oregon

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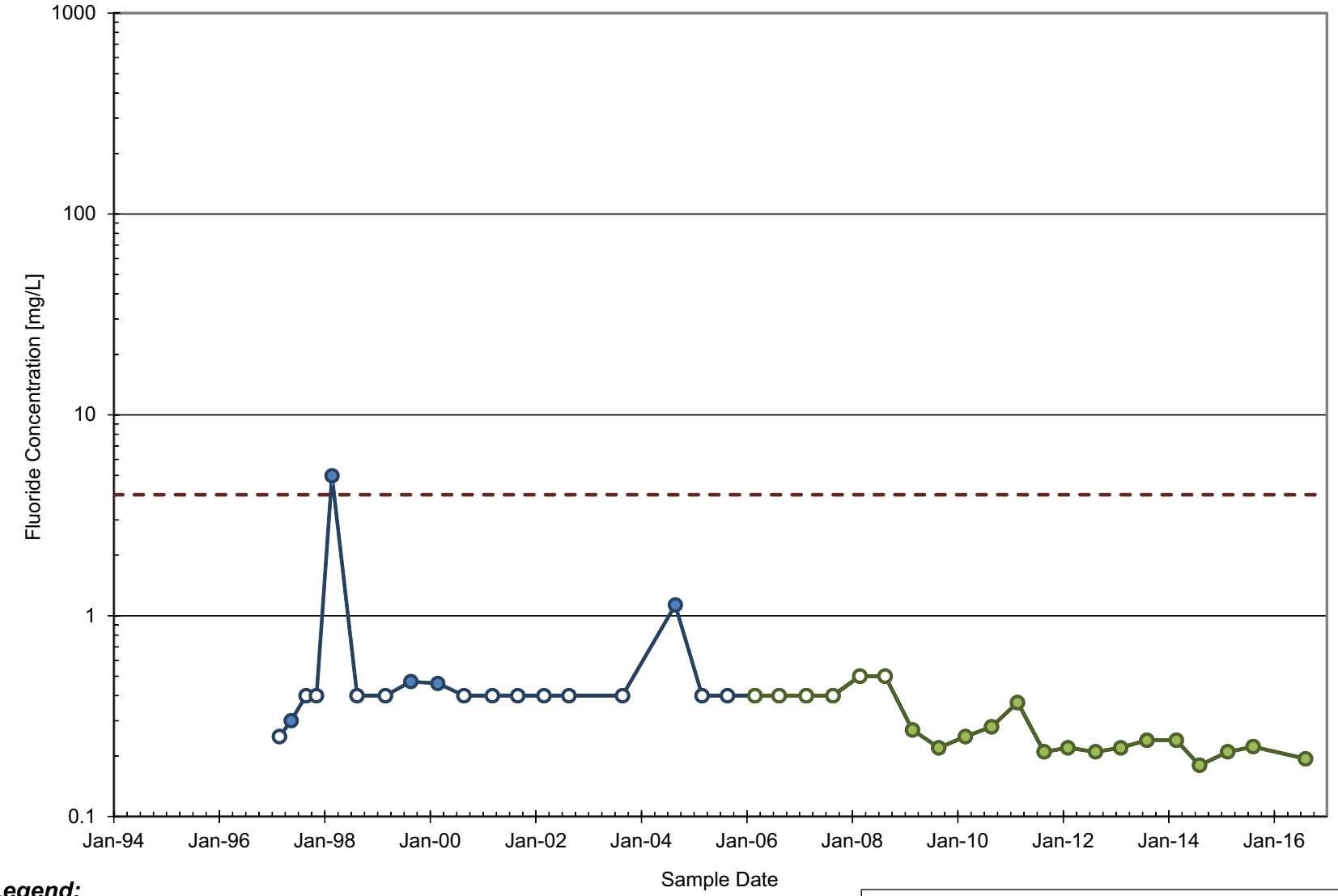
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-30



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW31-034

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Troutdale, Oregon

Apex Companies, LLC
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Portland, Oregon 97201

Project Number	1069-70	Figure
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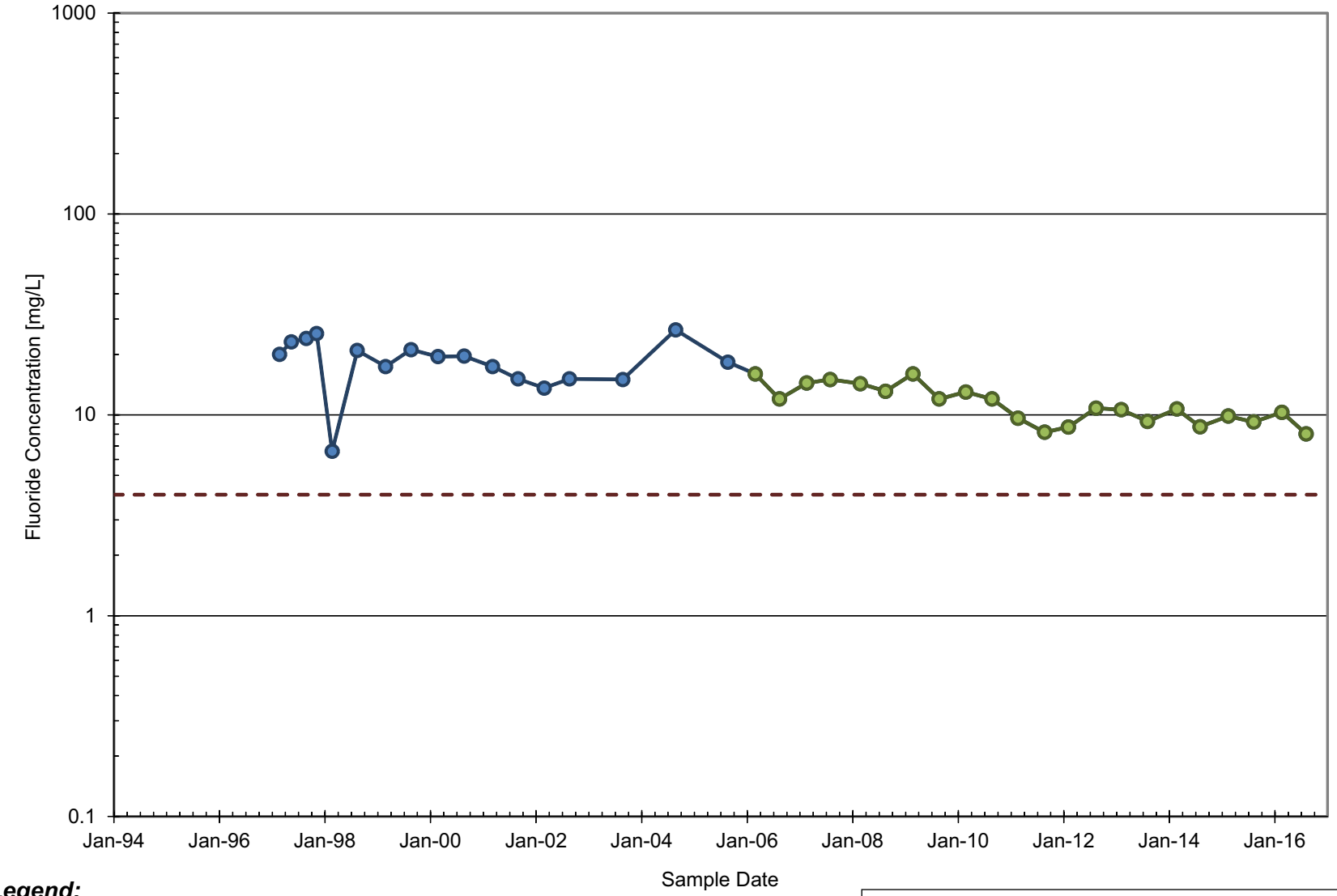

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW31-095R

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Portland, Oregon 97201

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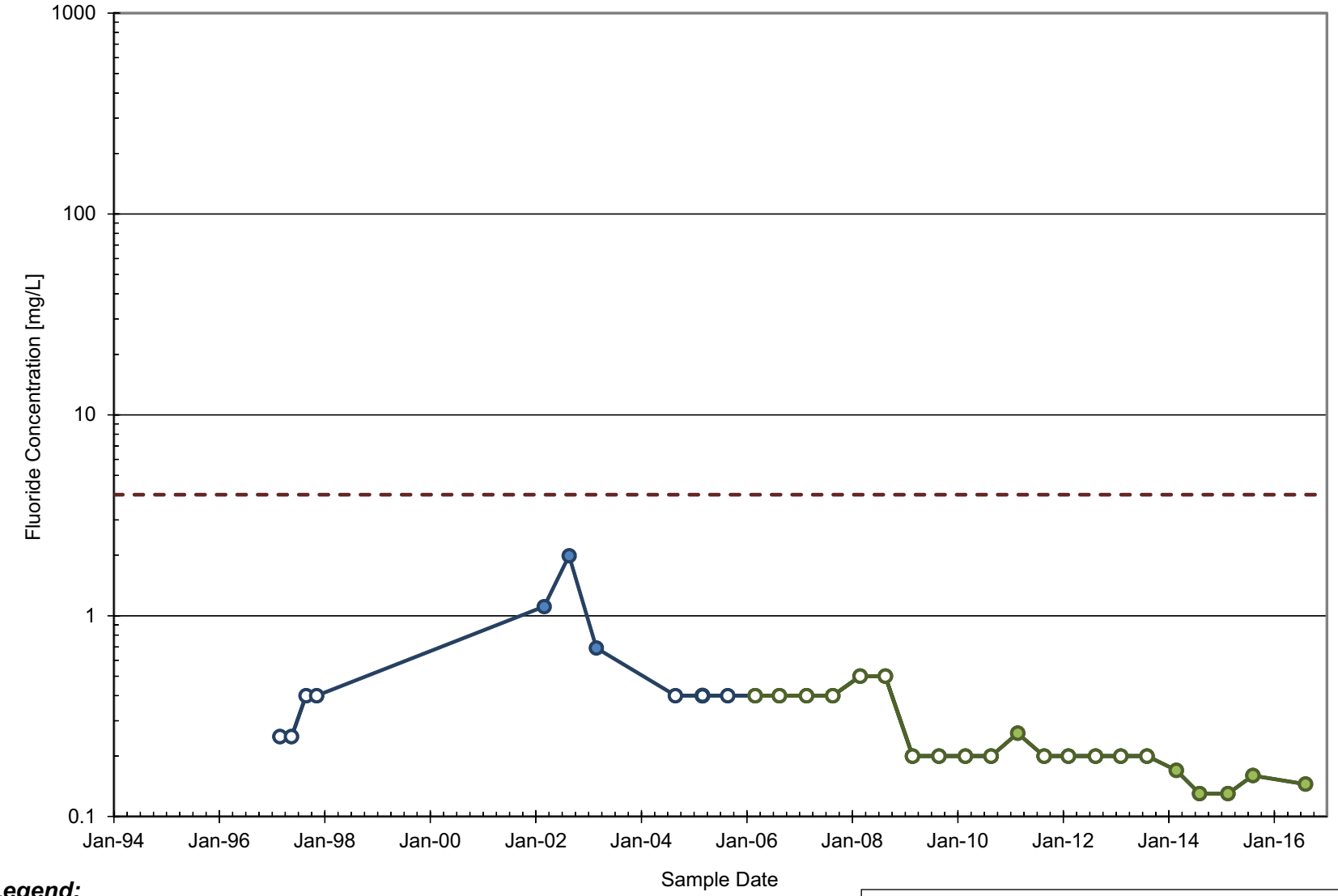

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW33-033

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Project Number	1069-70	Figure
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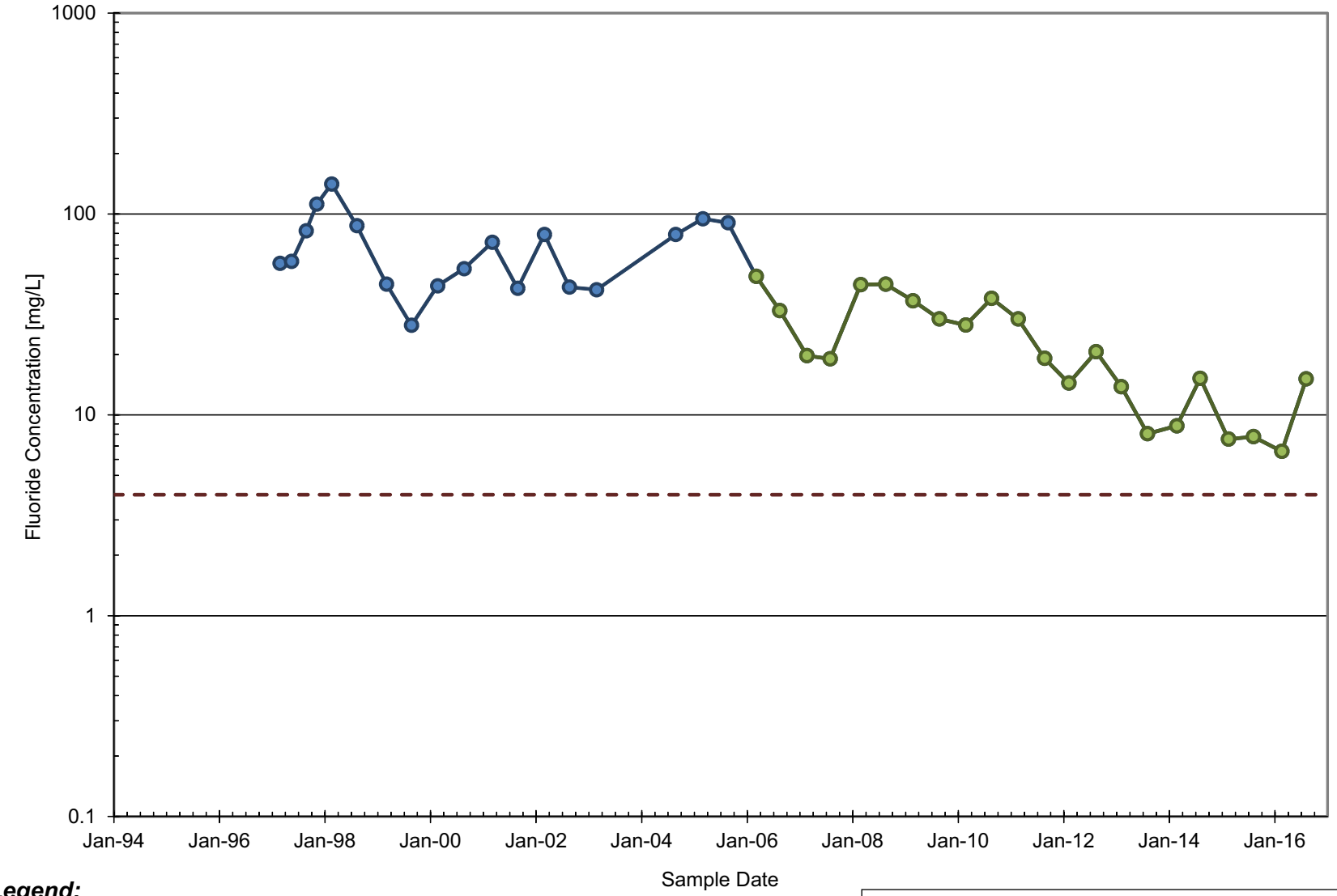

Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW33-095

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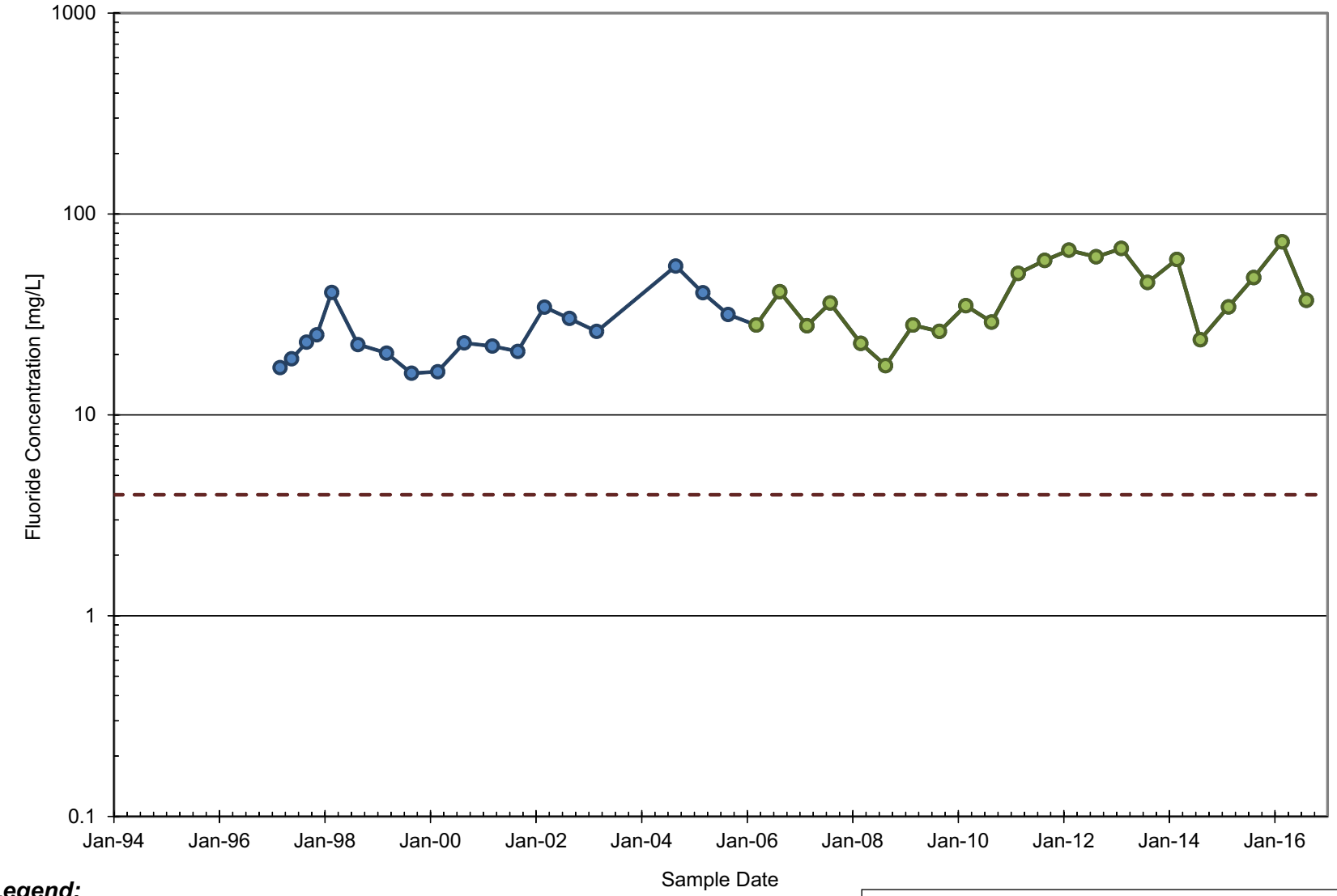
Project Number	1069-70	Figure
January 2017		B-34



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

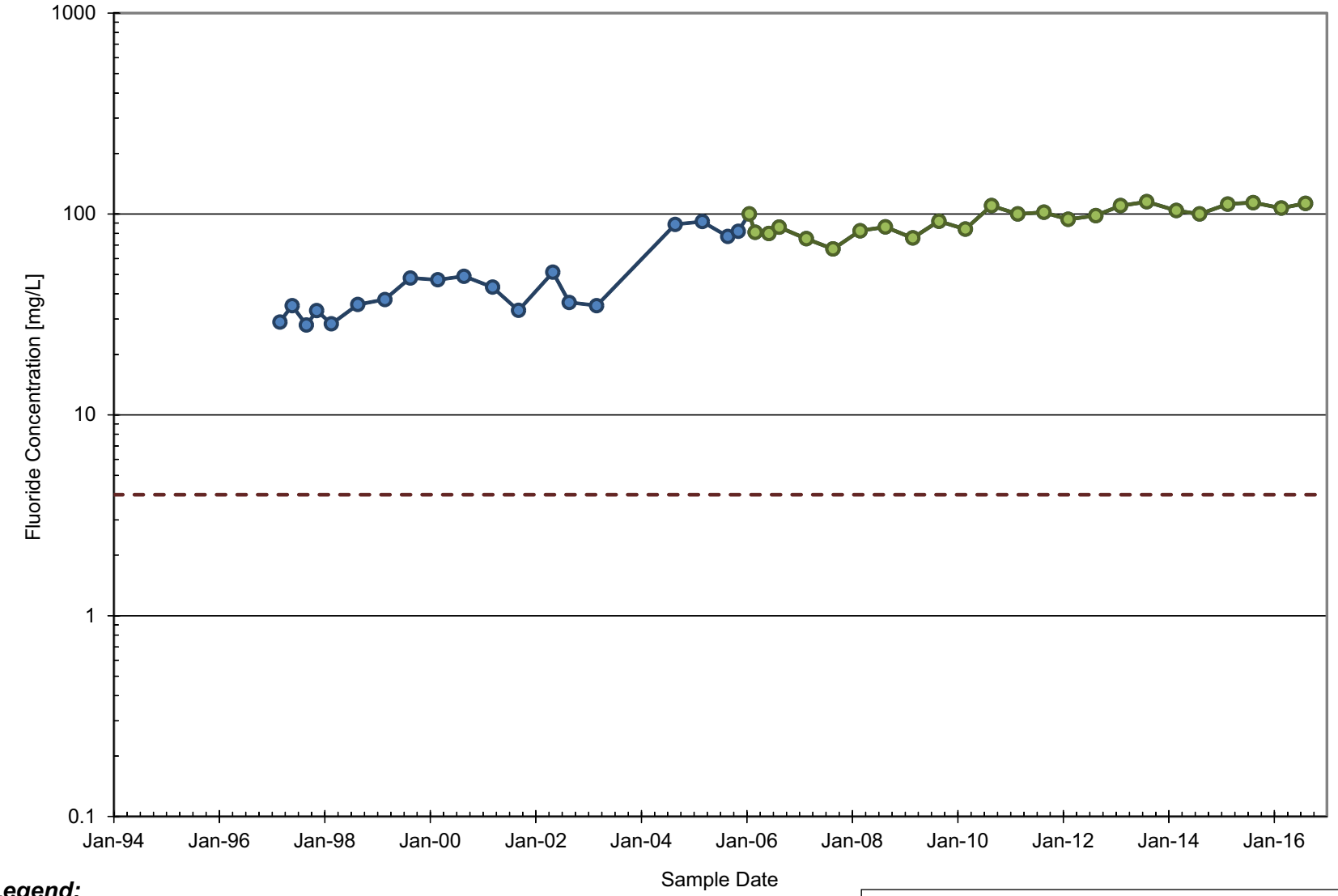
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW33-165

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-35



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

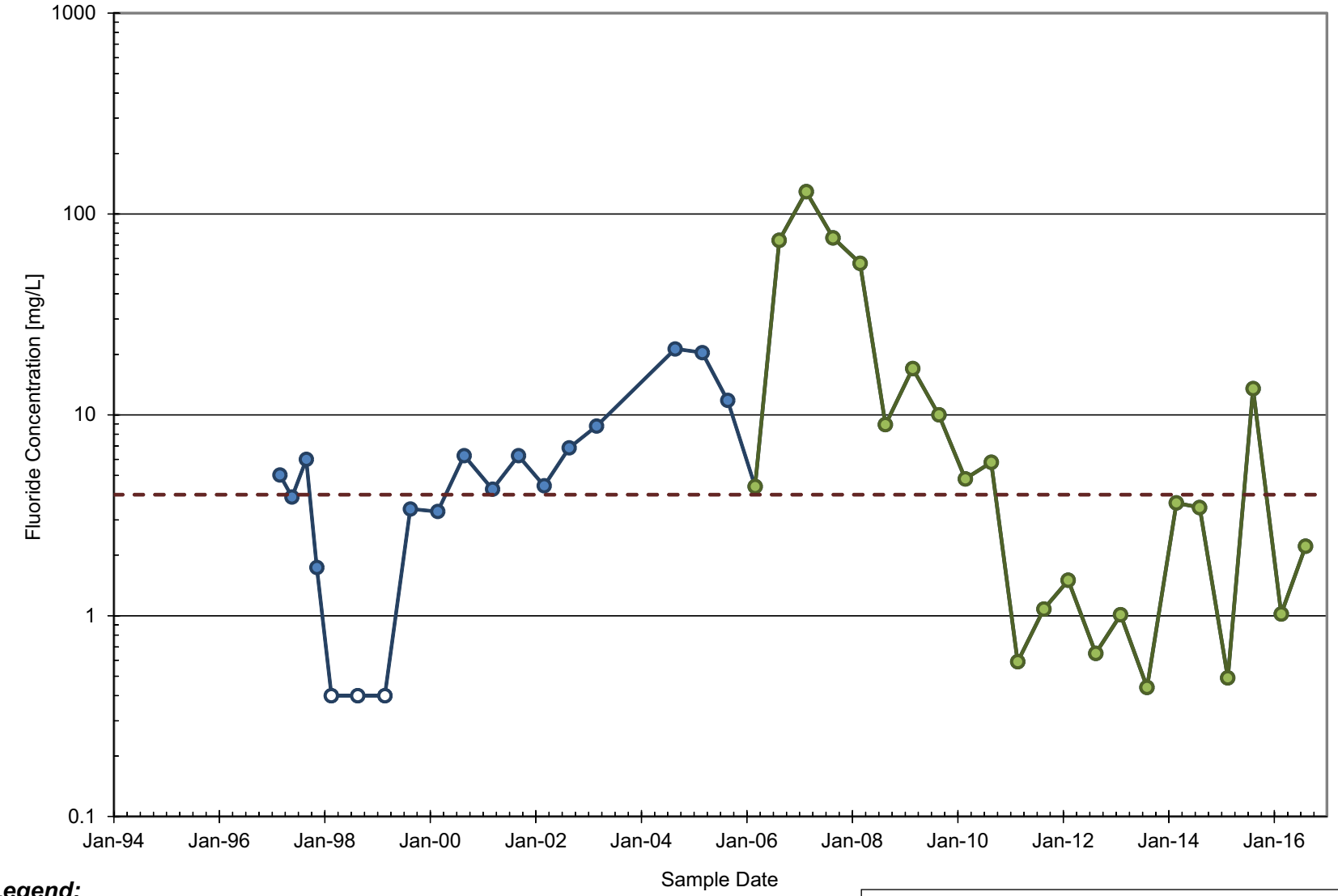
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW34-038

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-36



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

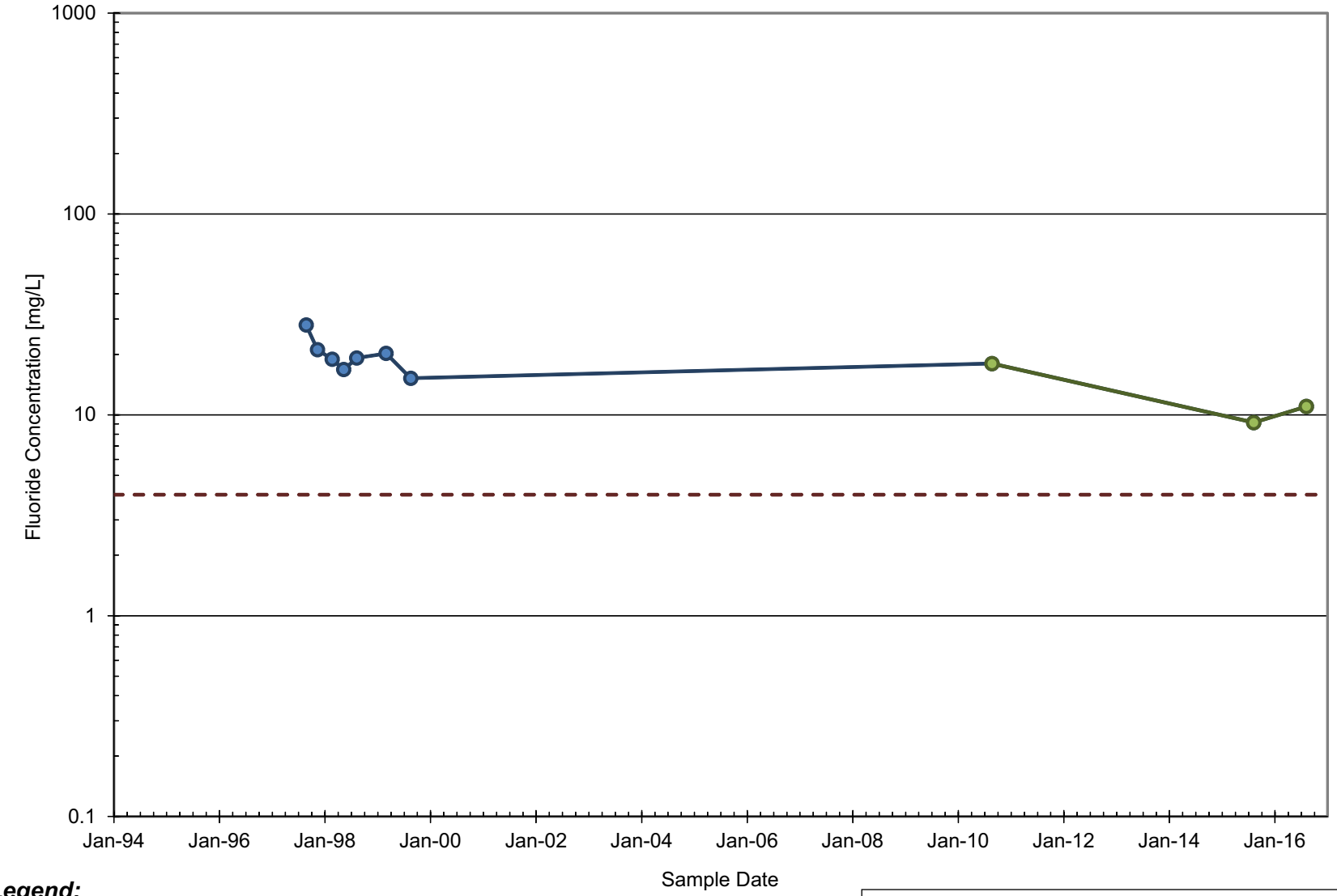
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW35-038

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-37



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

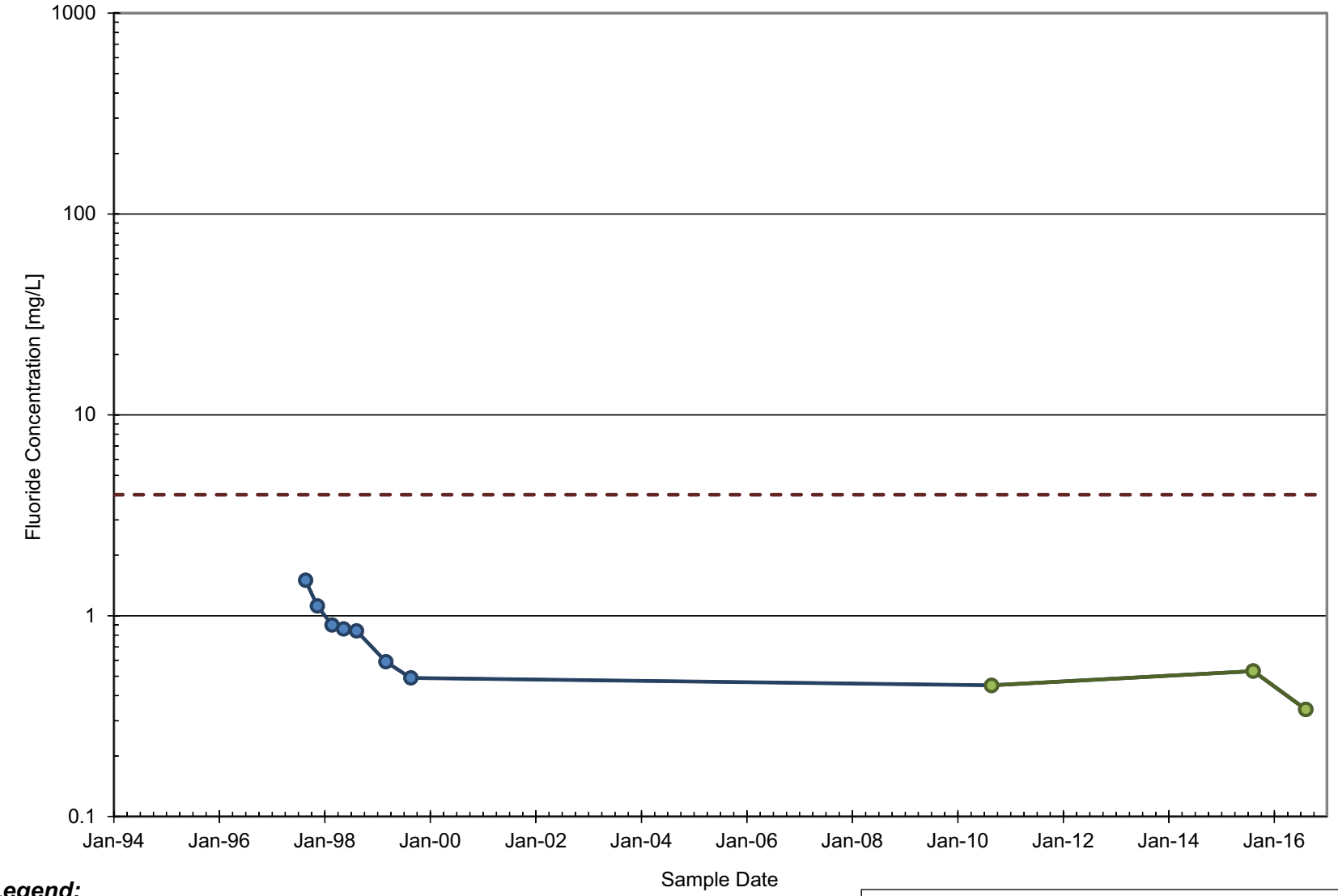
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW46-018

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-38



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

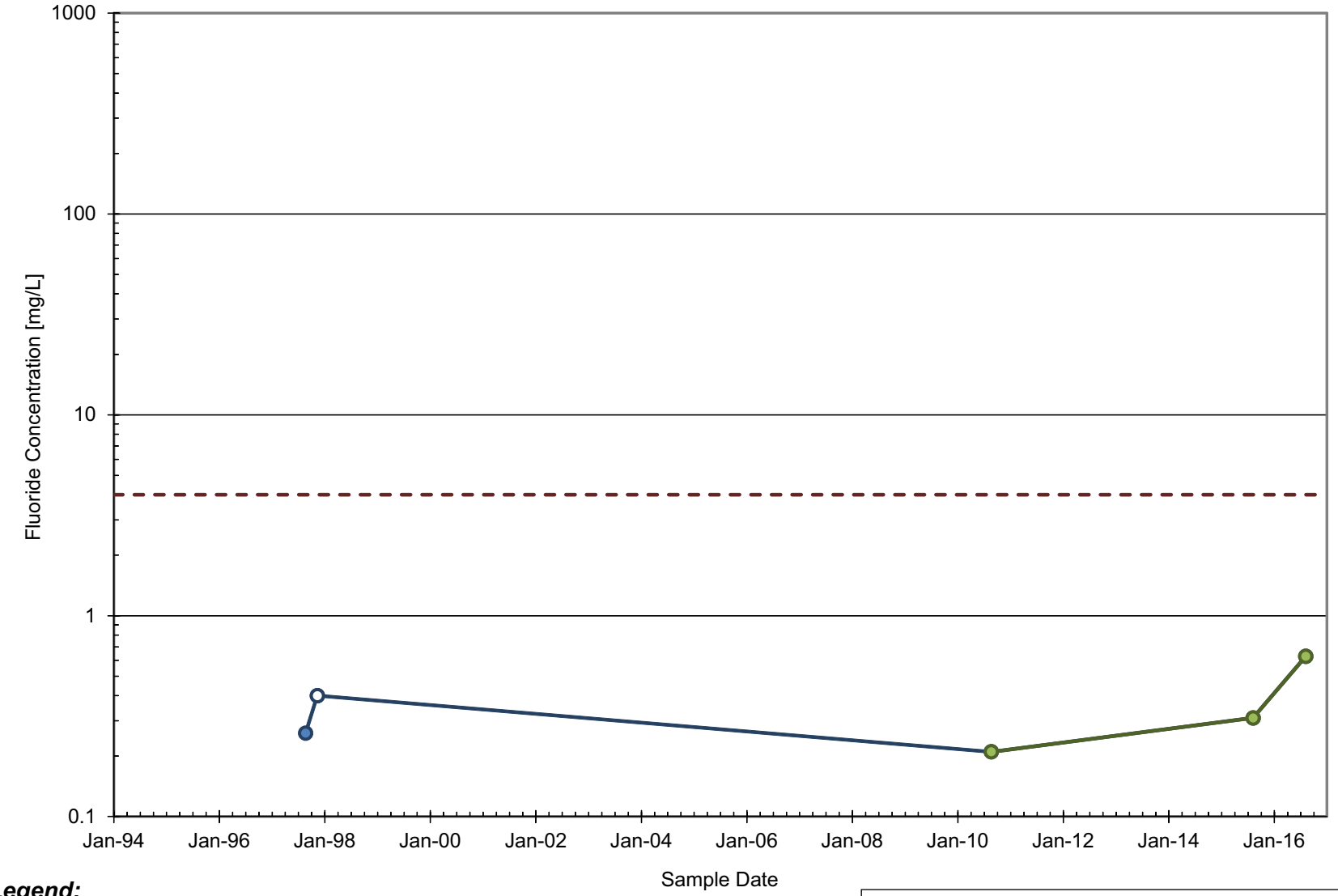
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW46-043

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-39



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW47-094

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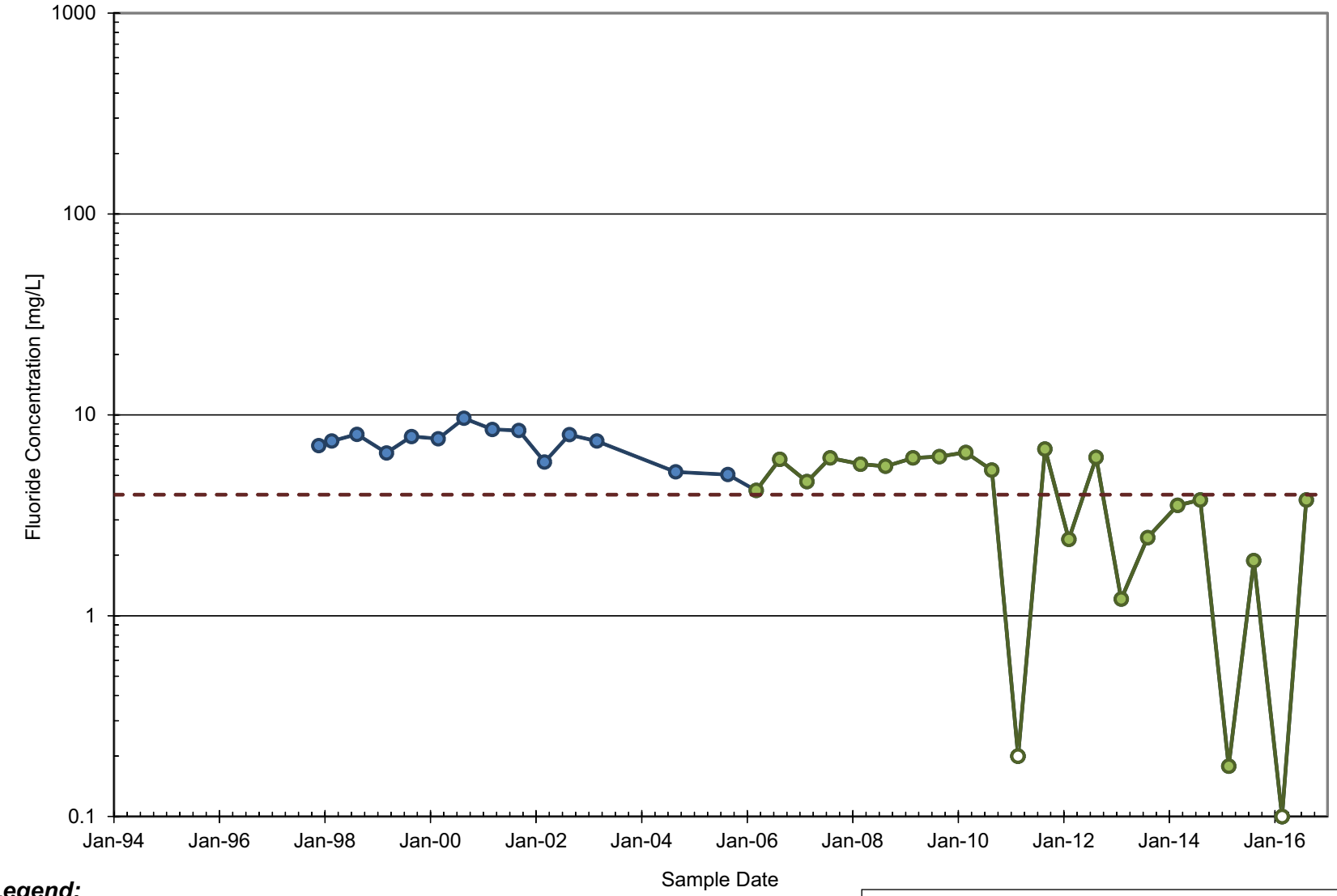
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-40



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

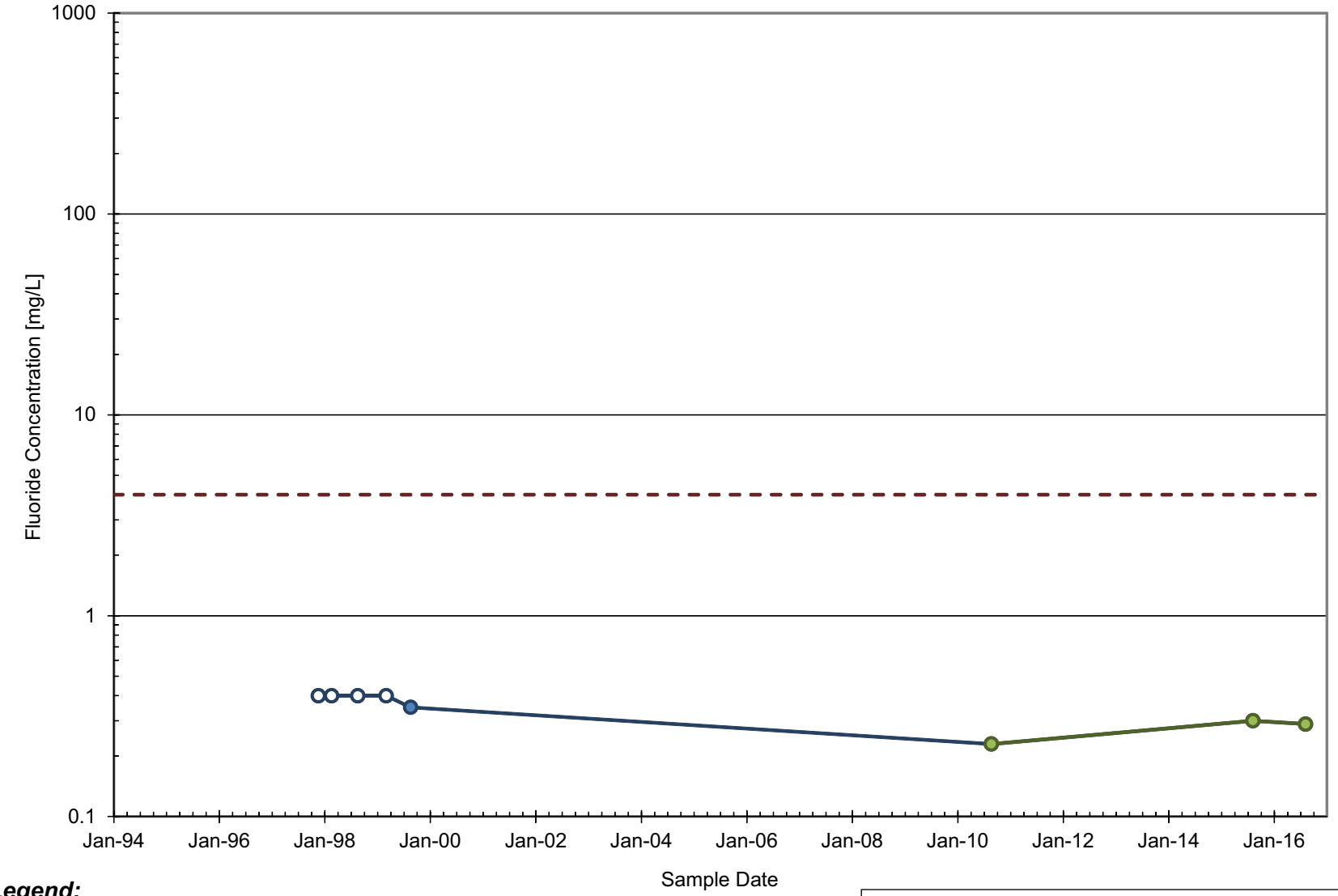
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW48-165

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-41



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

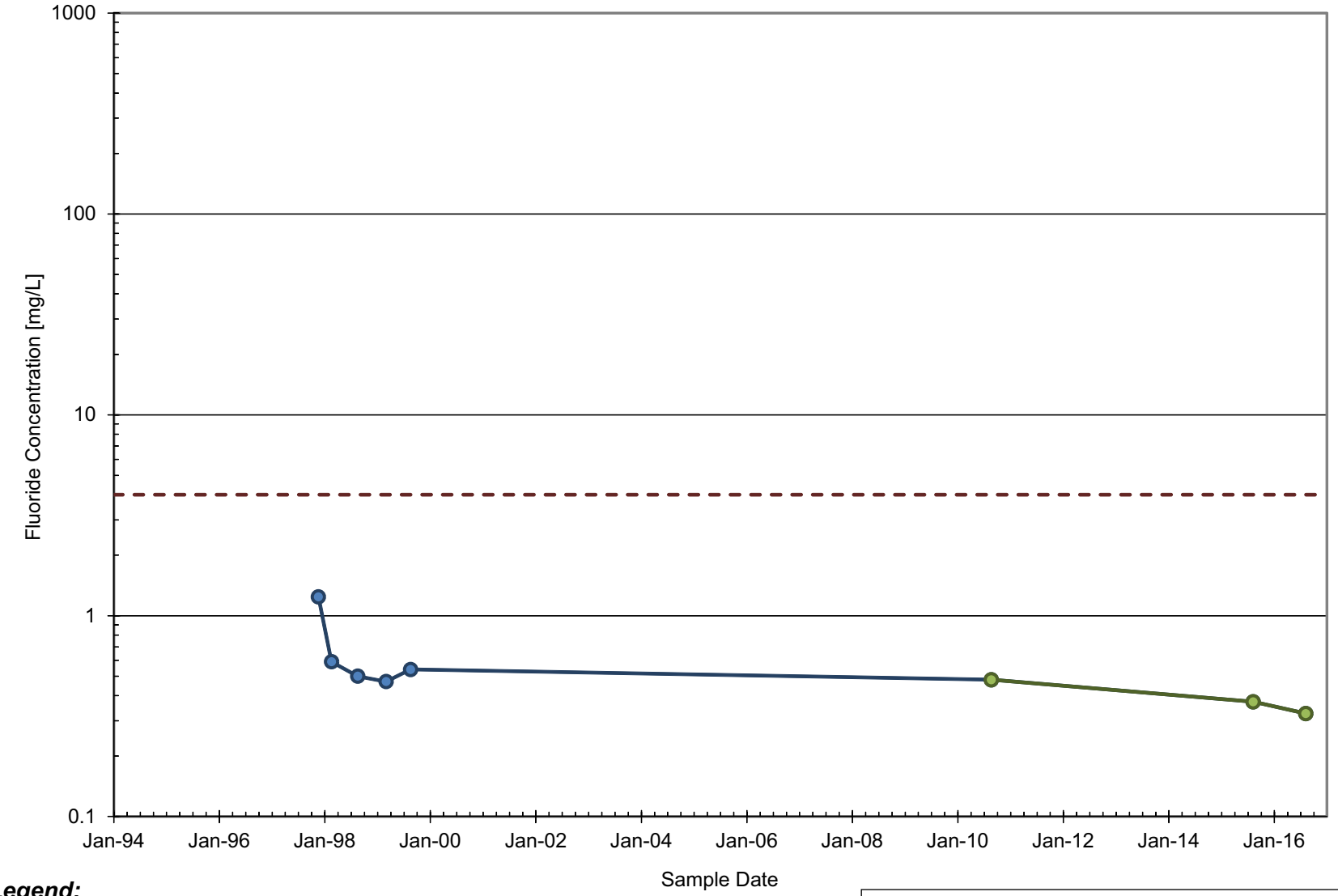
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW49-095

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-42



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

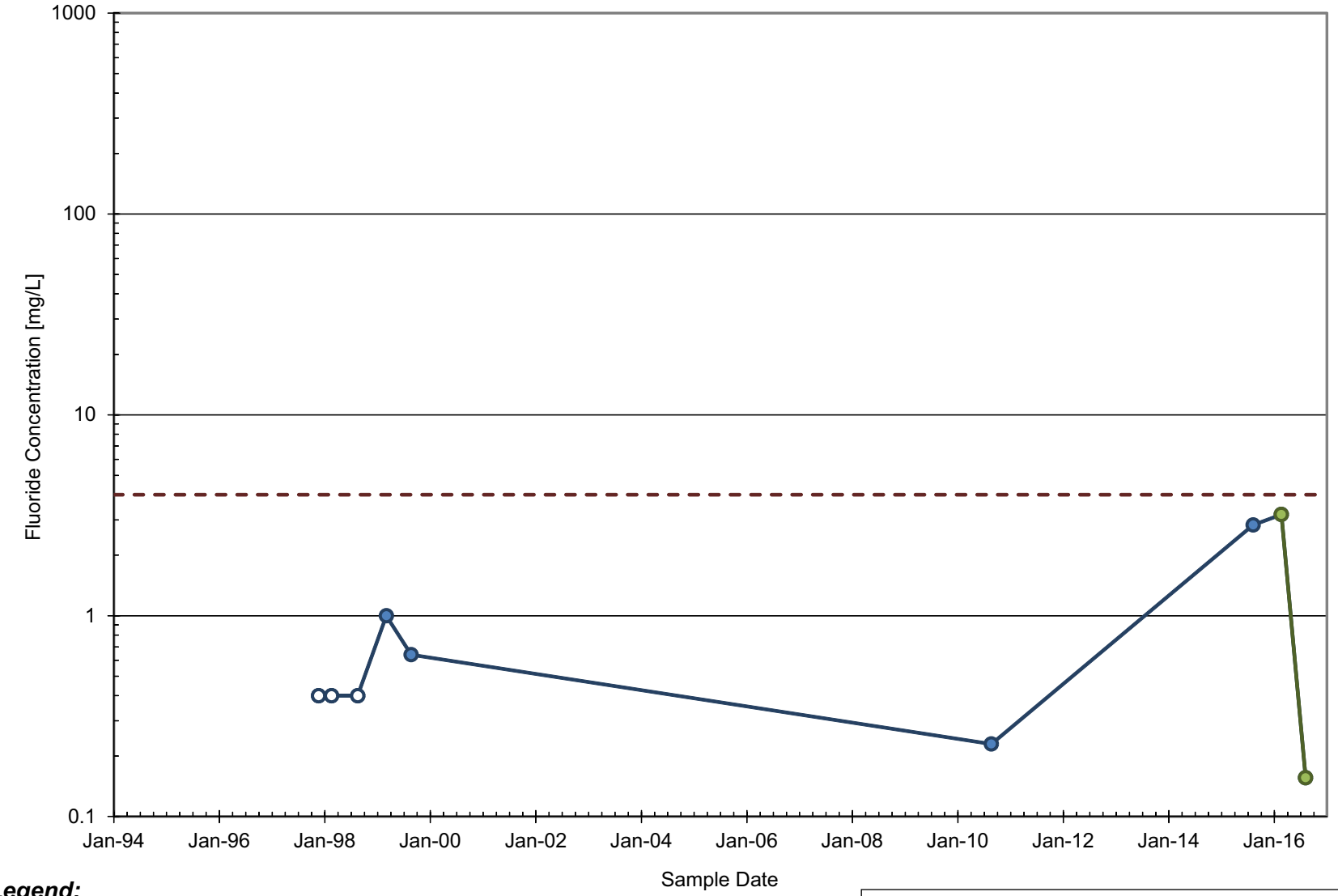
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW49-145

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-43



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

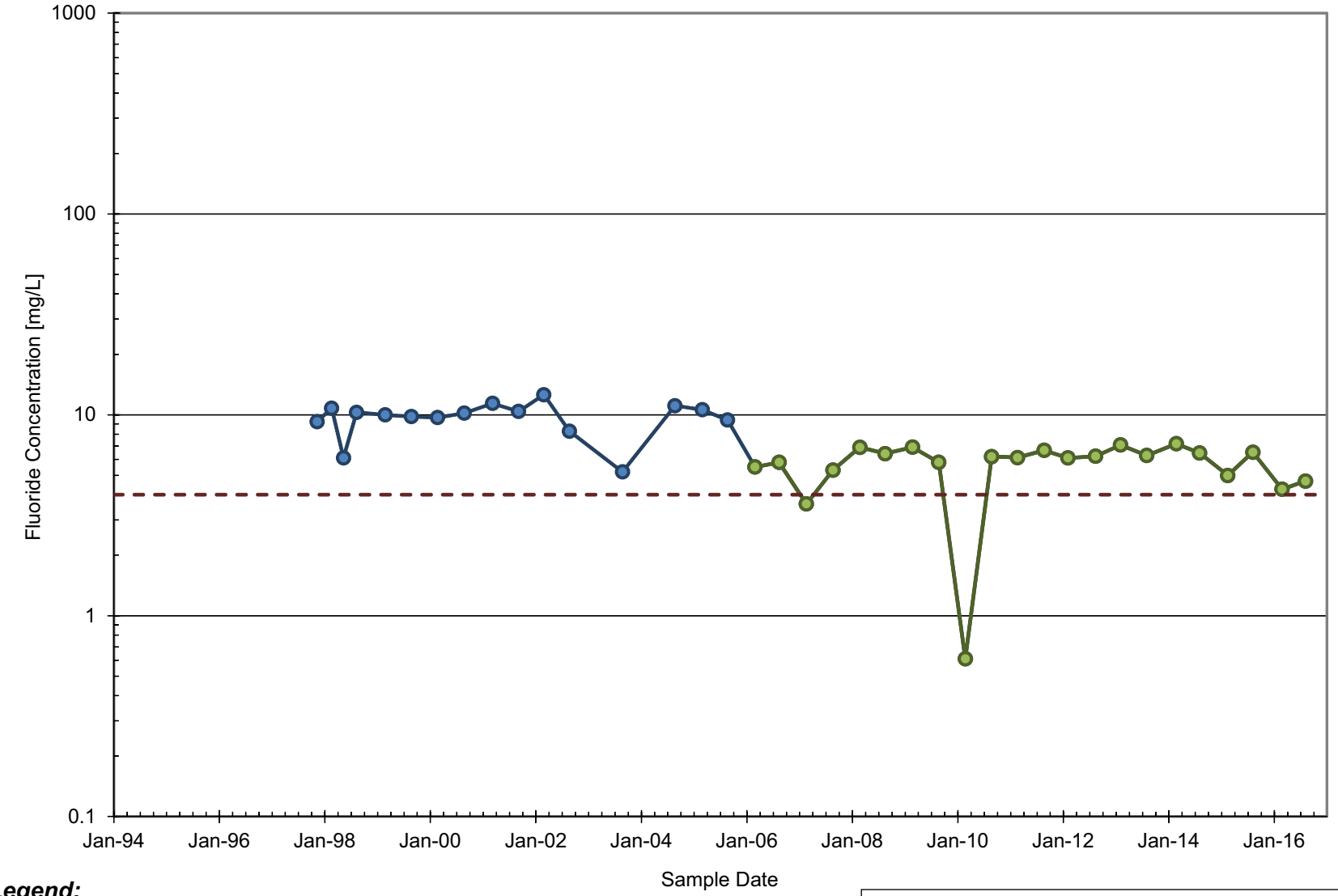
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW50-094

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-44



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

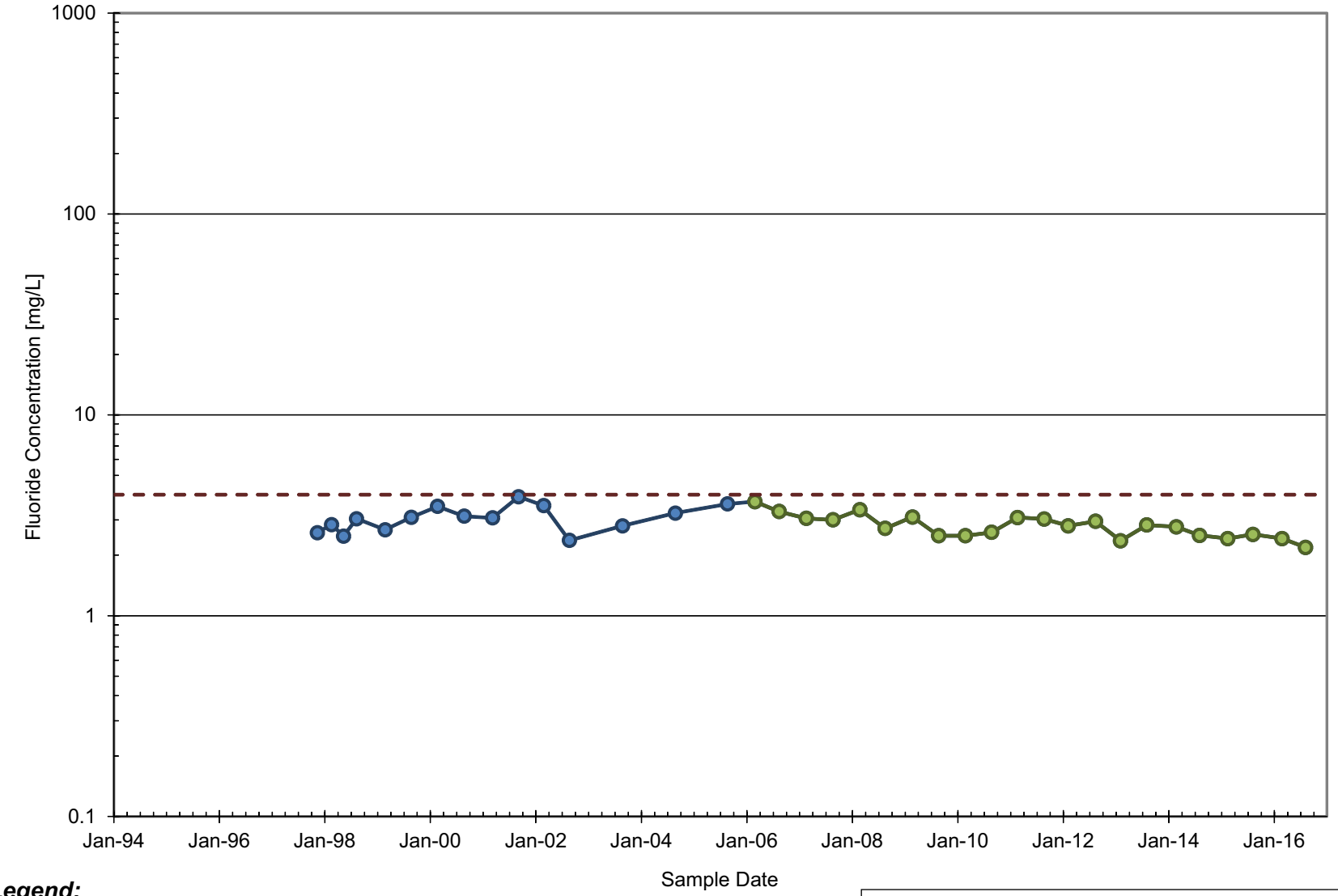
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW52-045

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-45



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW53-034

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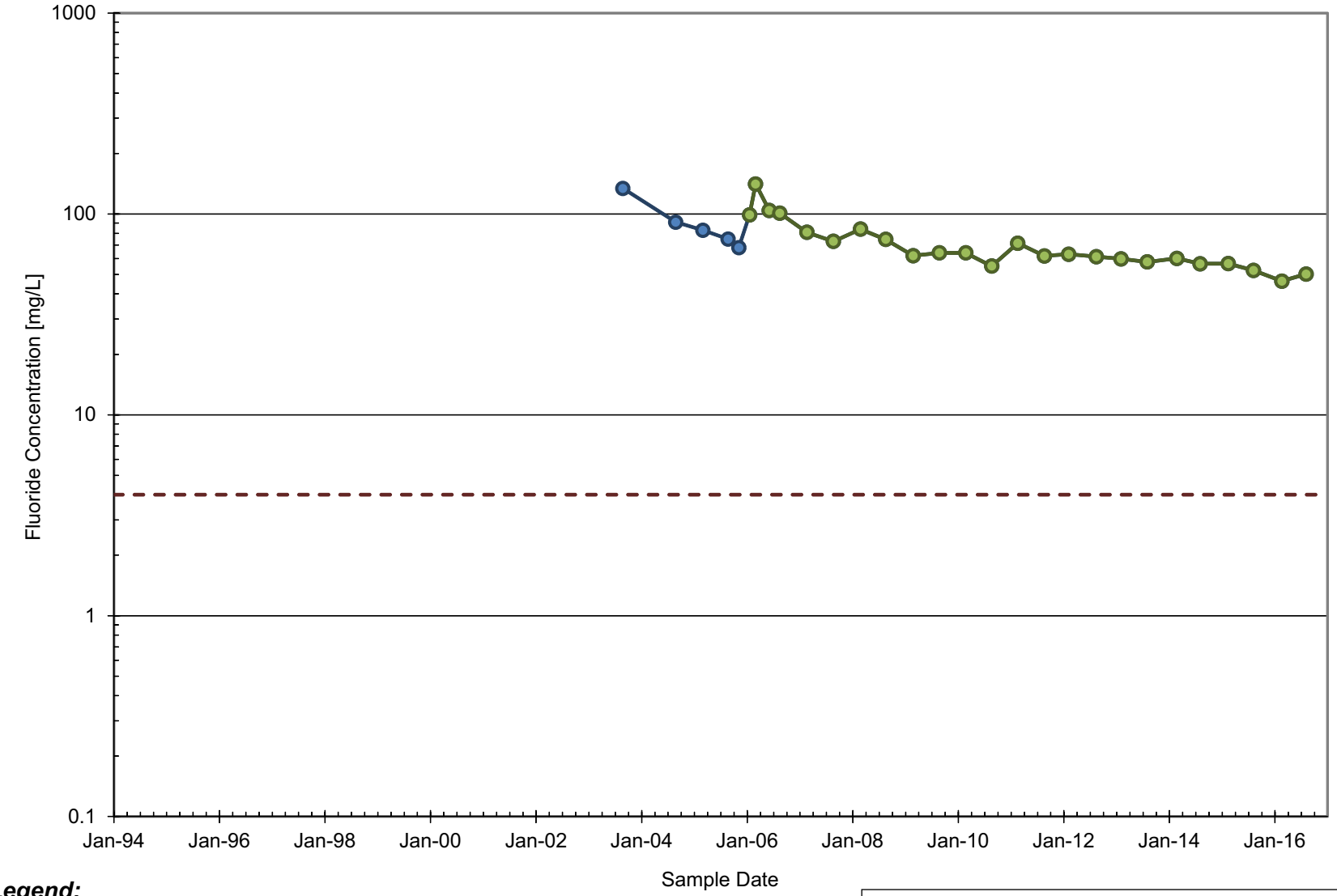
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-46



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

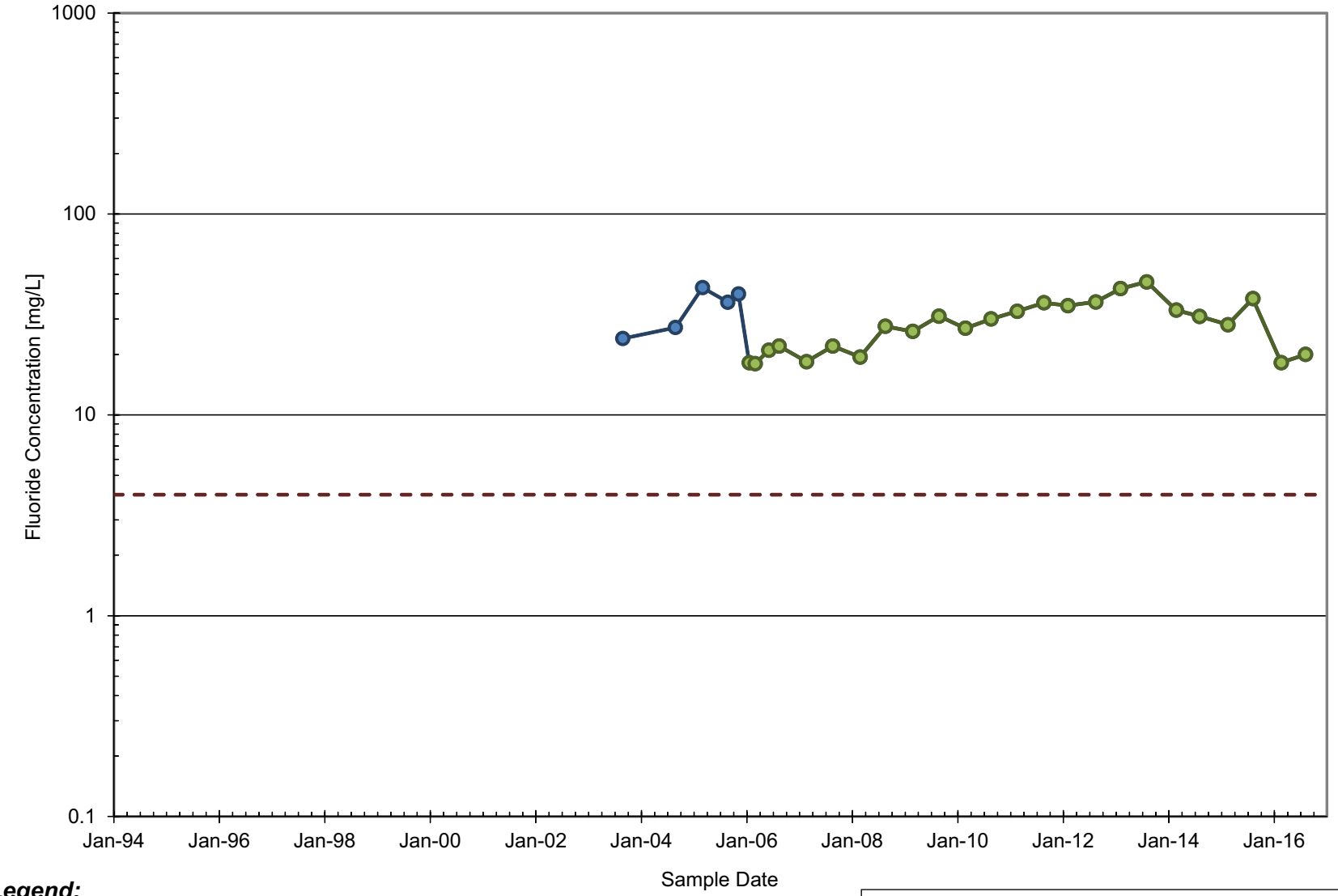
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW55-046

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-47



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

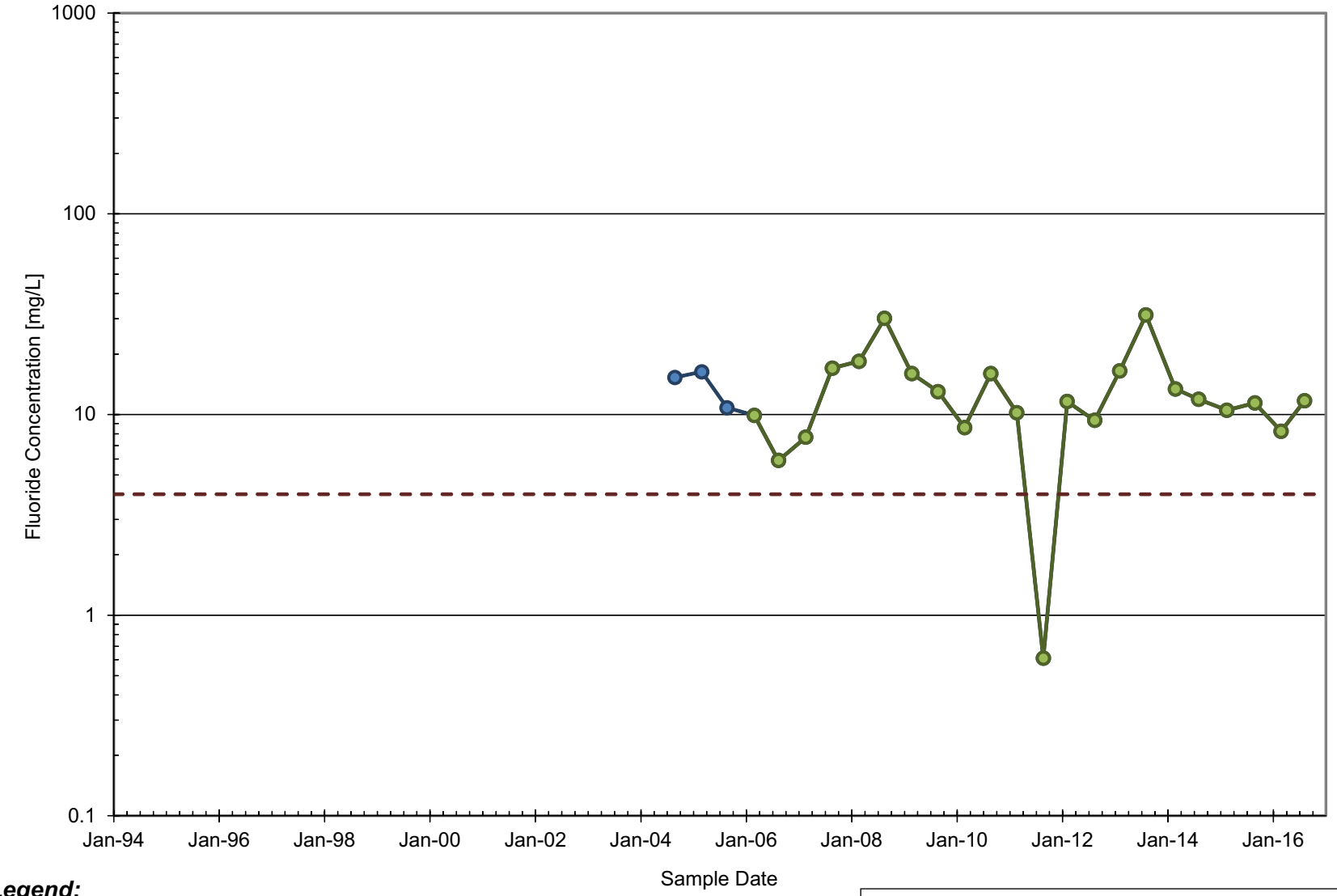
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW56-046

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-48



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW57-025

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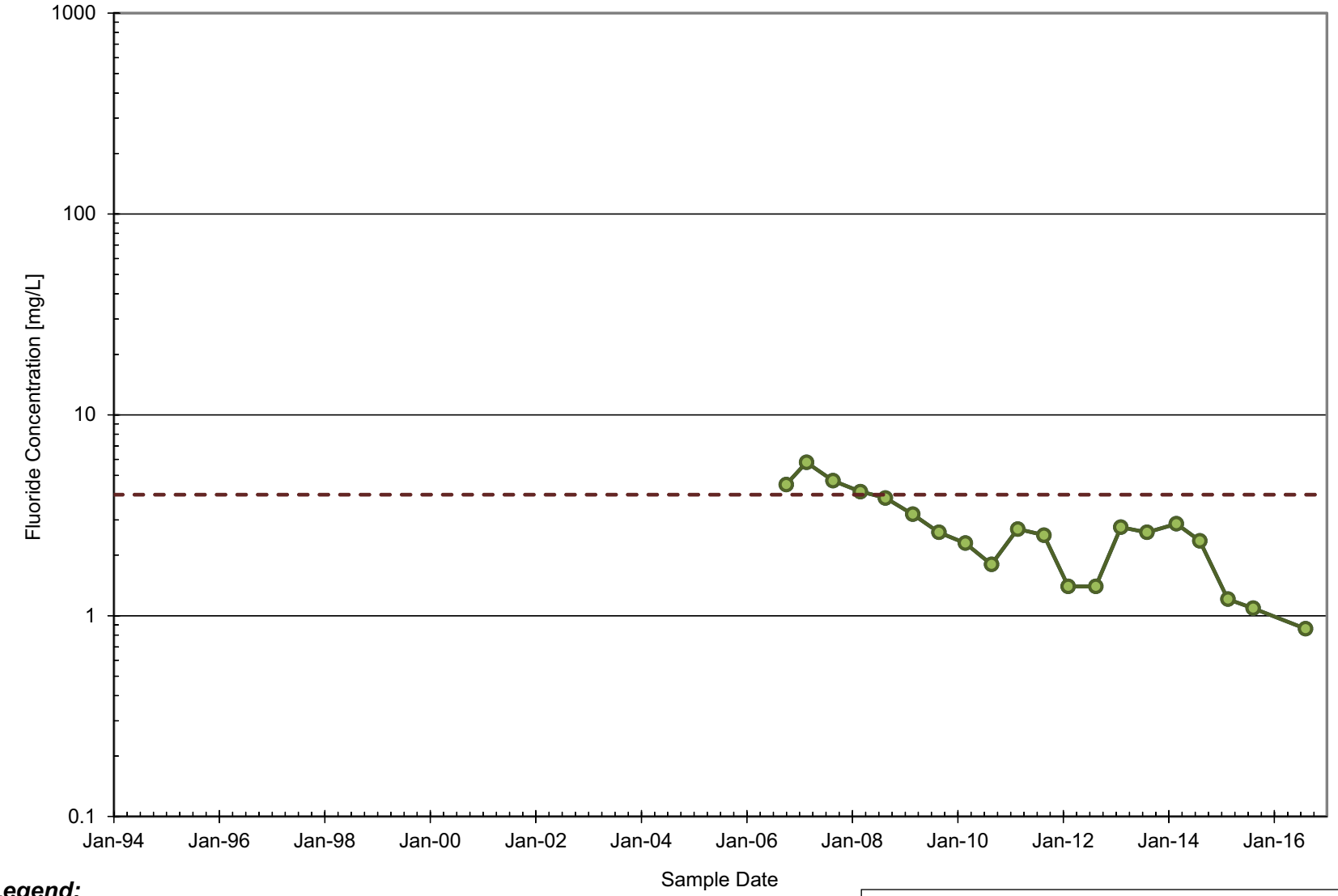
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-49



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

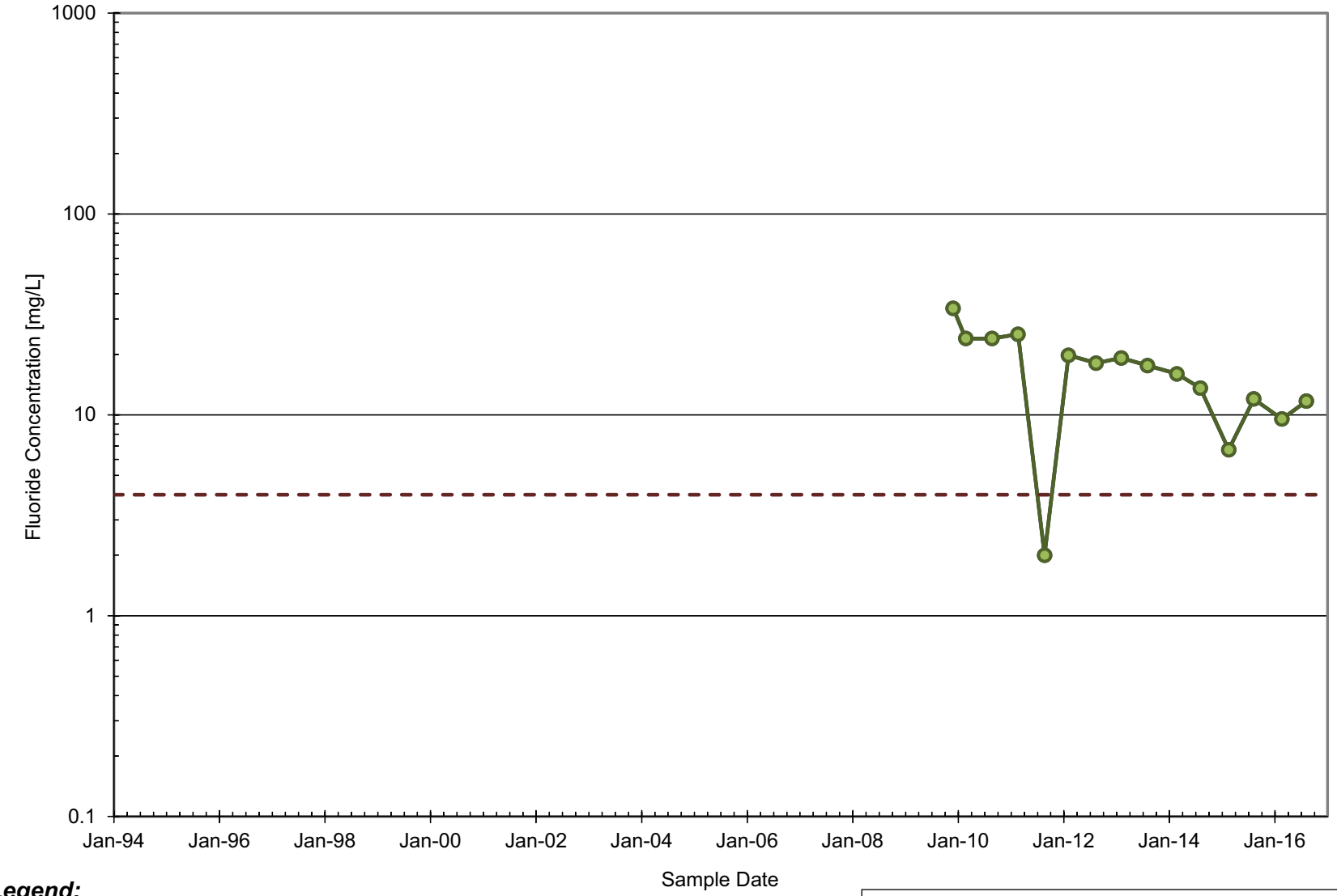
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW58-042

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-50



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

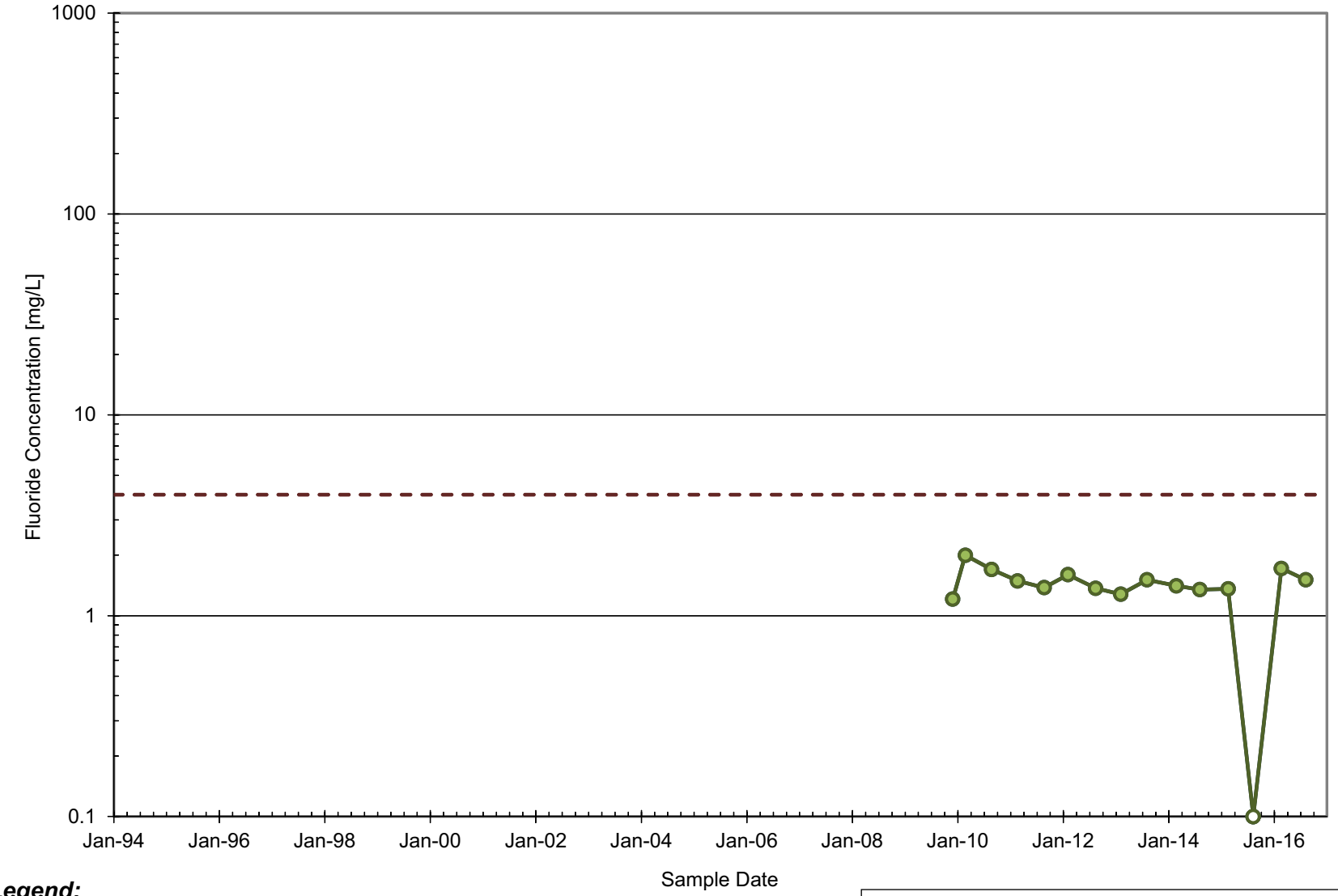
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW59-019

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-51



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

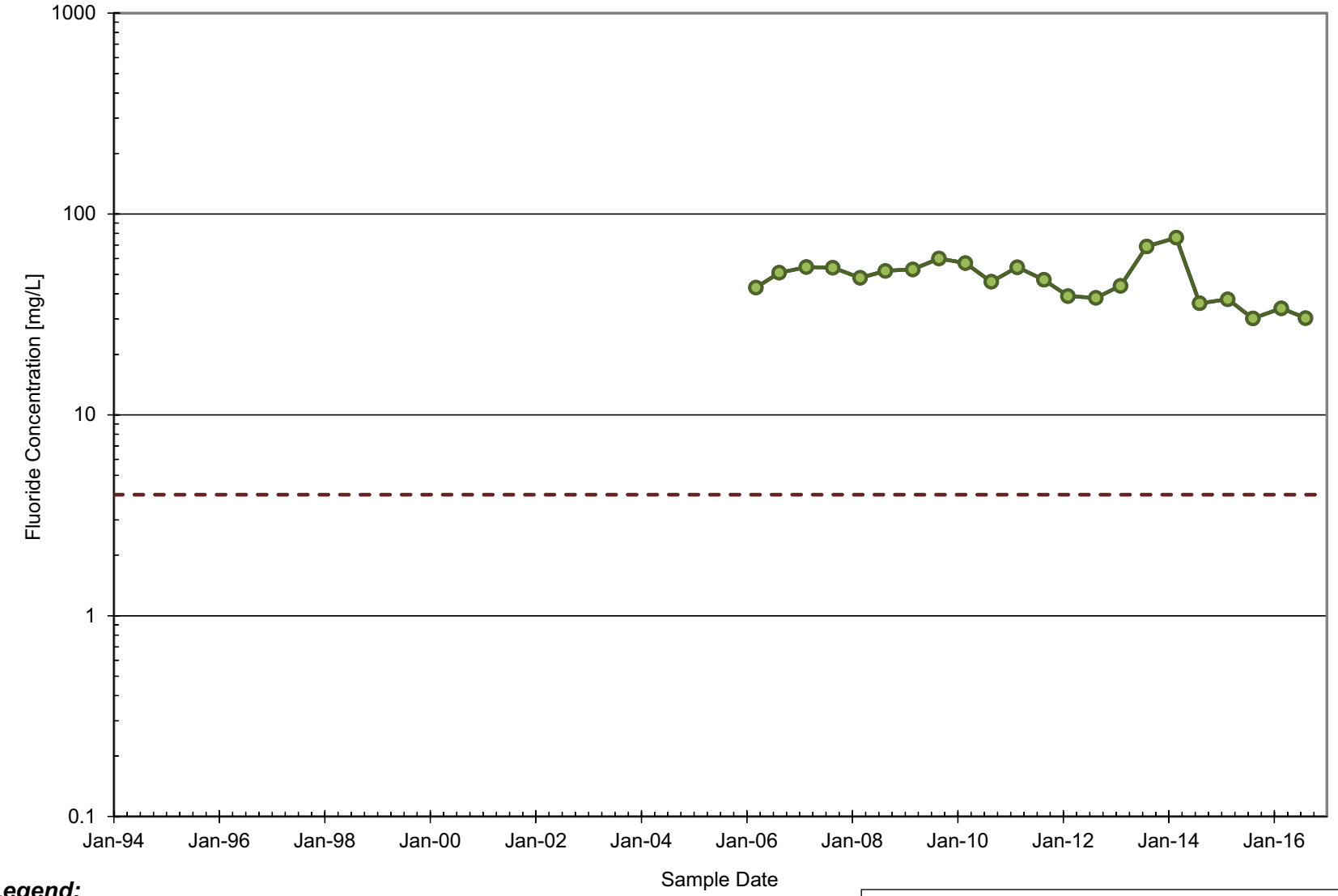
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: MW59-038

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-52



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

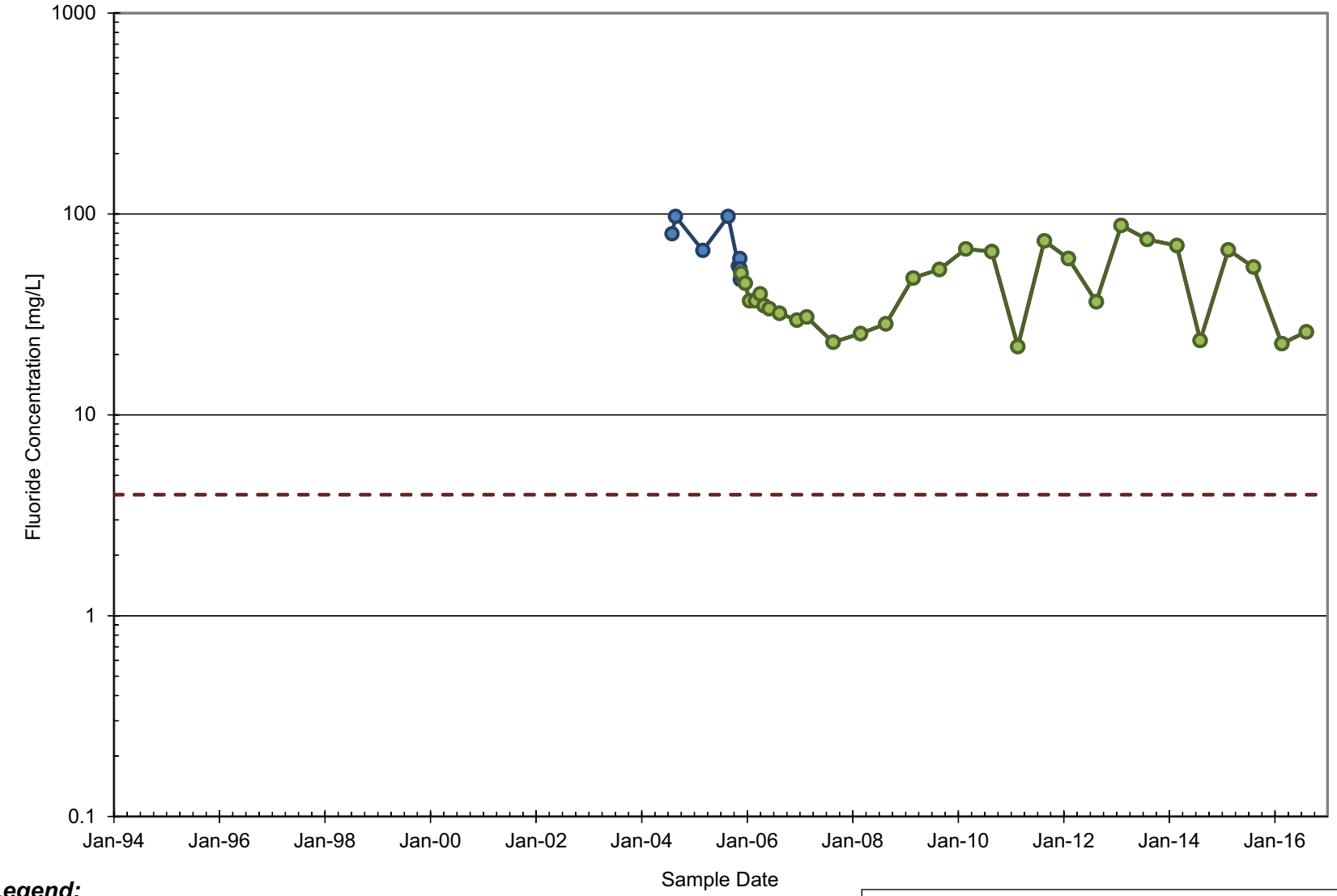
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: FE01-046

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-53



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: FE02-046

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70
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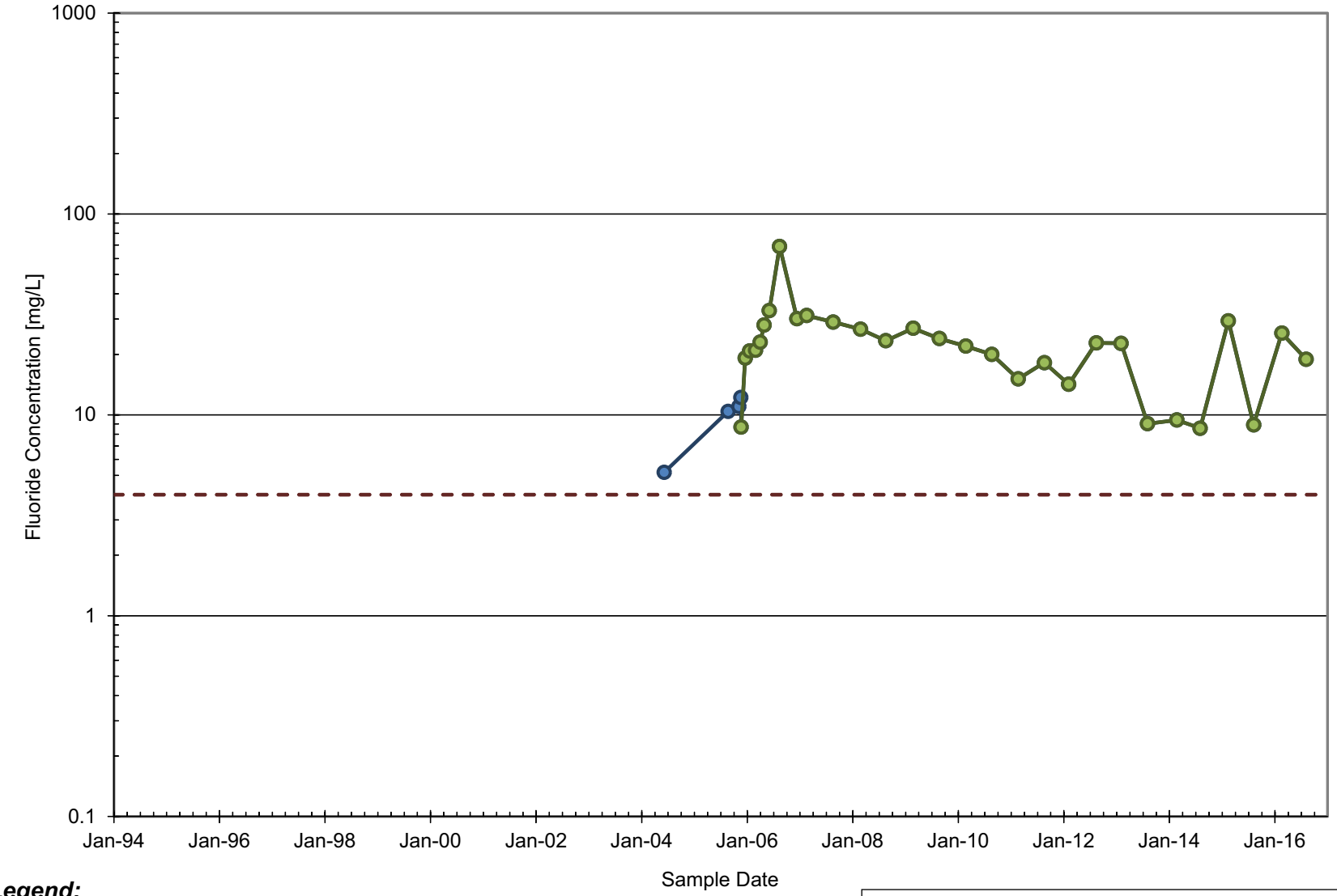
Figure B-54



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

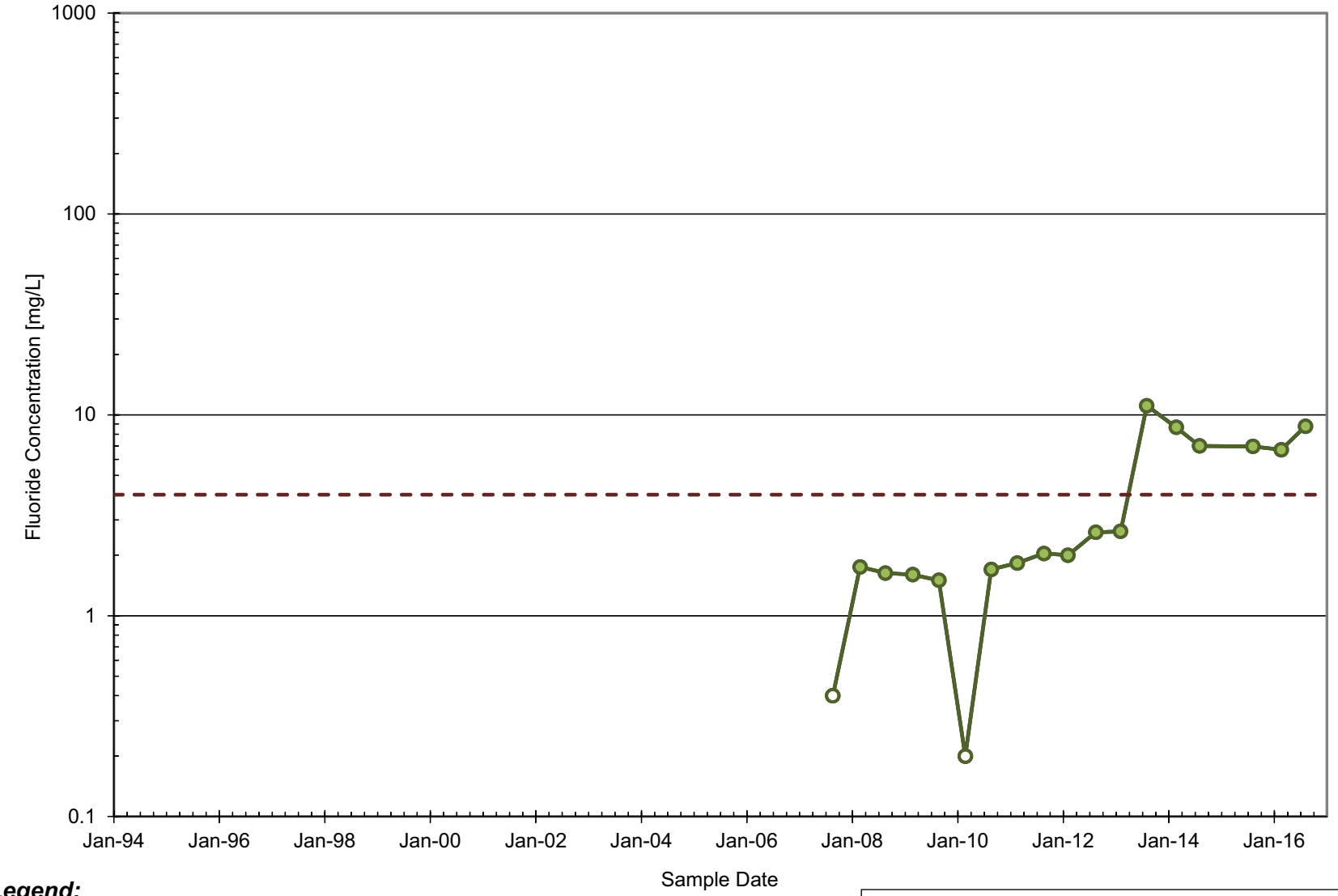
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: FE03-045

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-55



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: FE04-071

Troutdale Reynolds Industrial Property - 2016 Annual Report
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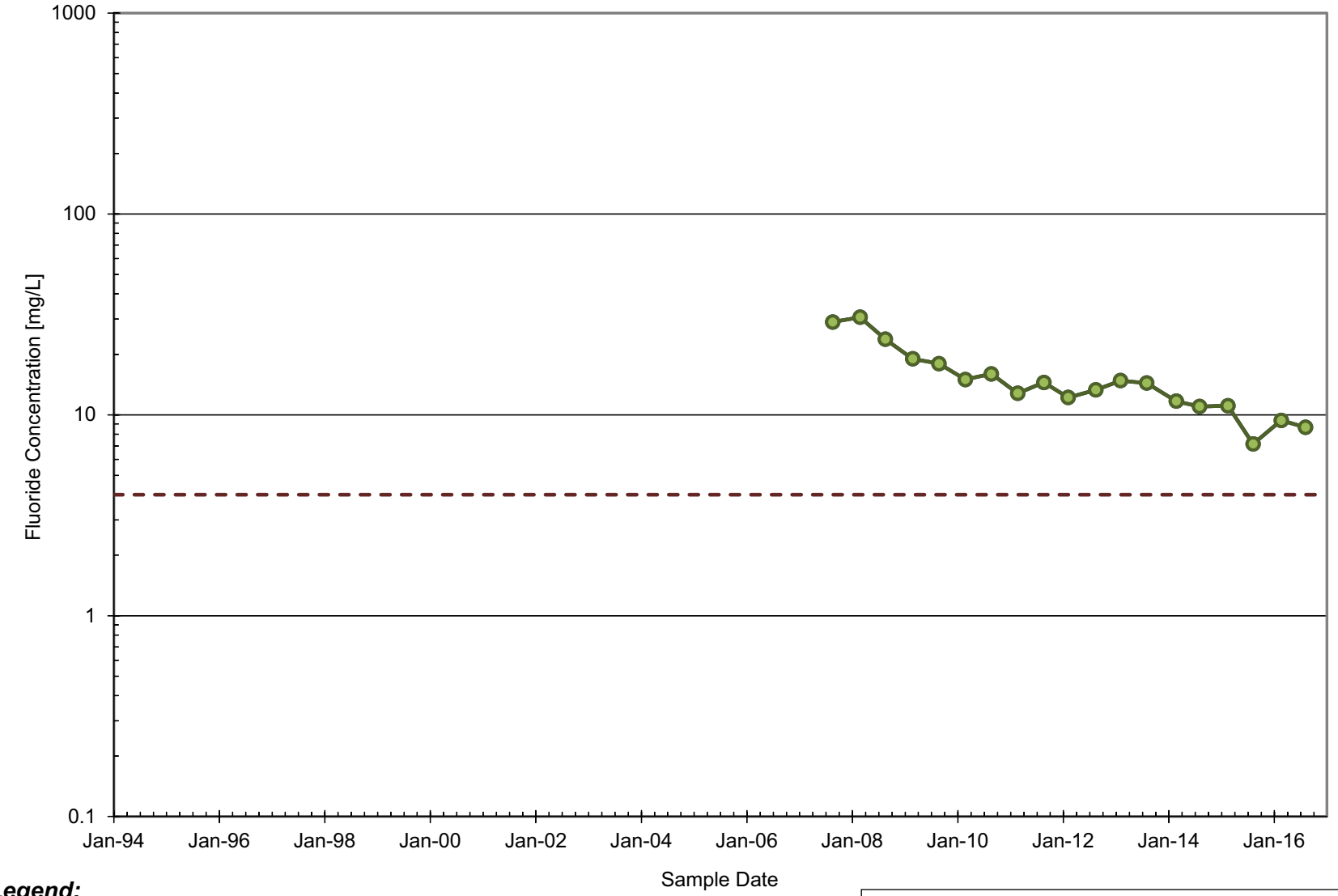
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-56



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: FE05-074

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Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70
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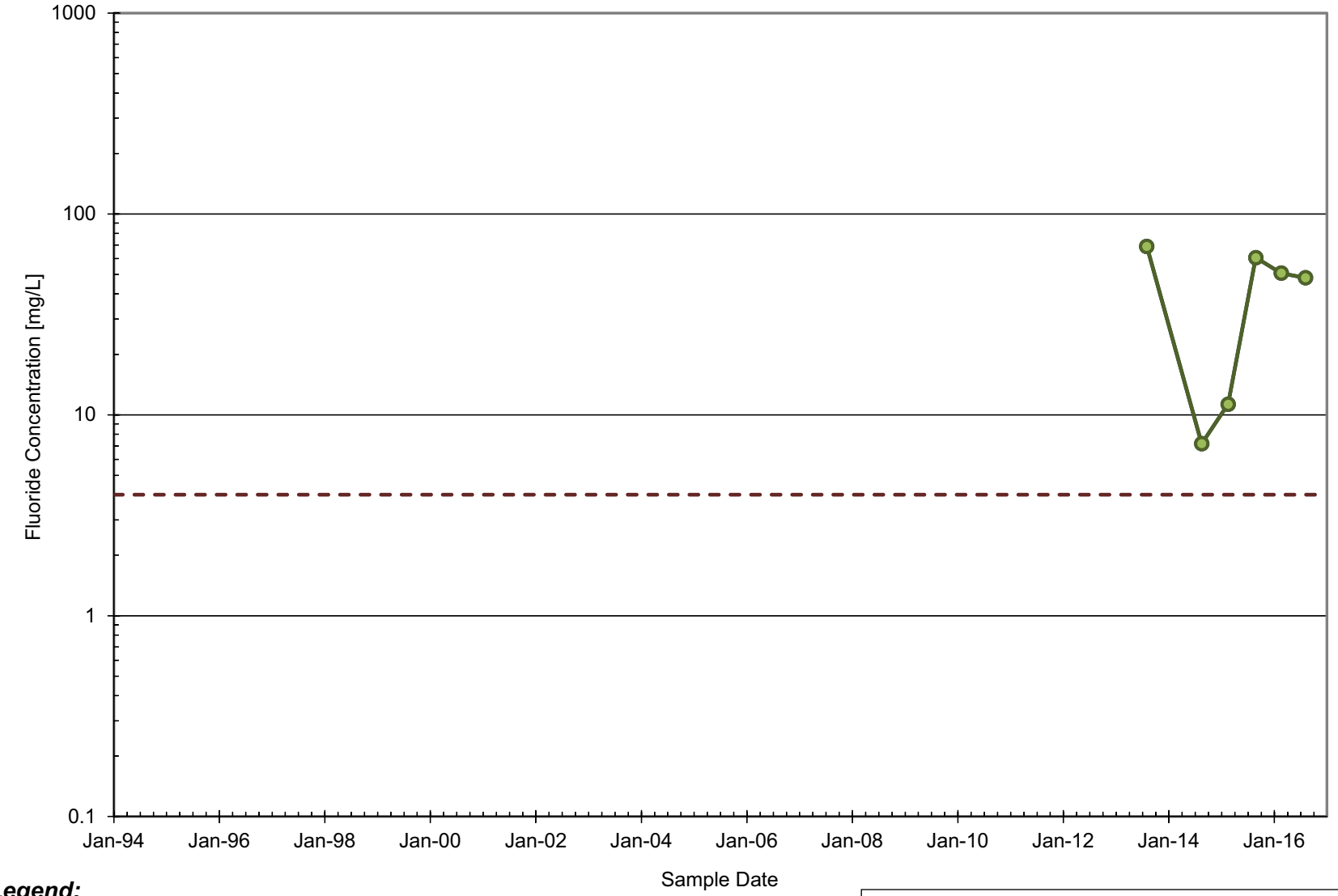
Figure B-57



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: FE06-047

Troutdale Reynolds Industrial Property - 2016 Annual Report
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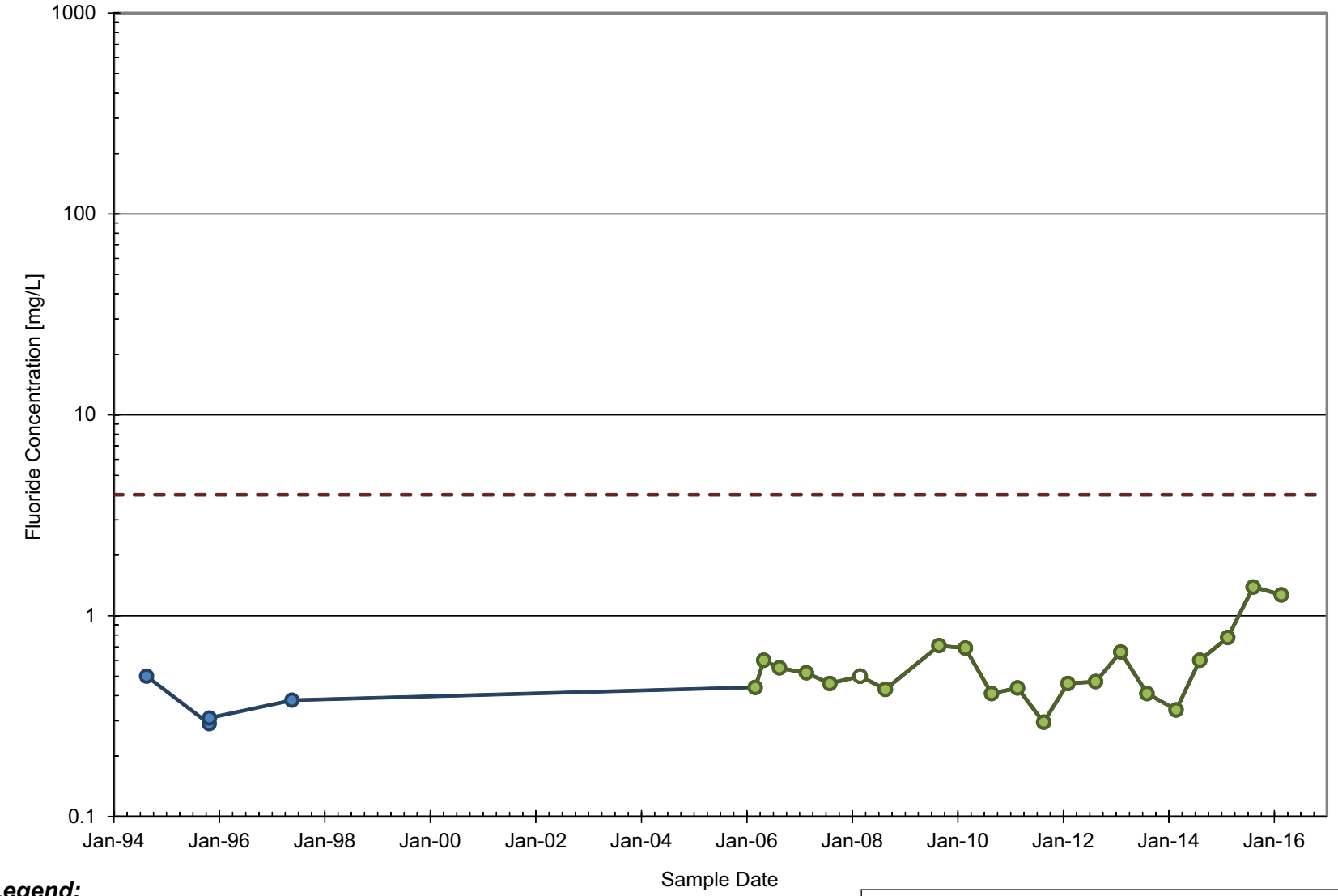
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-58



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: PW03

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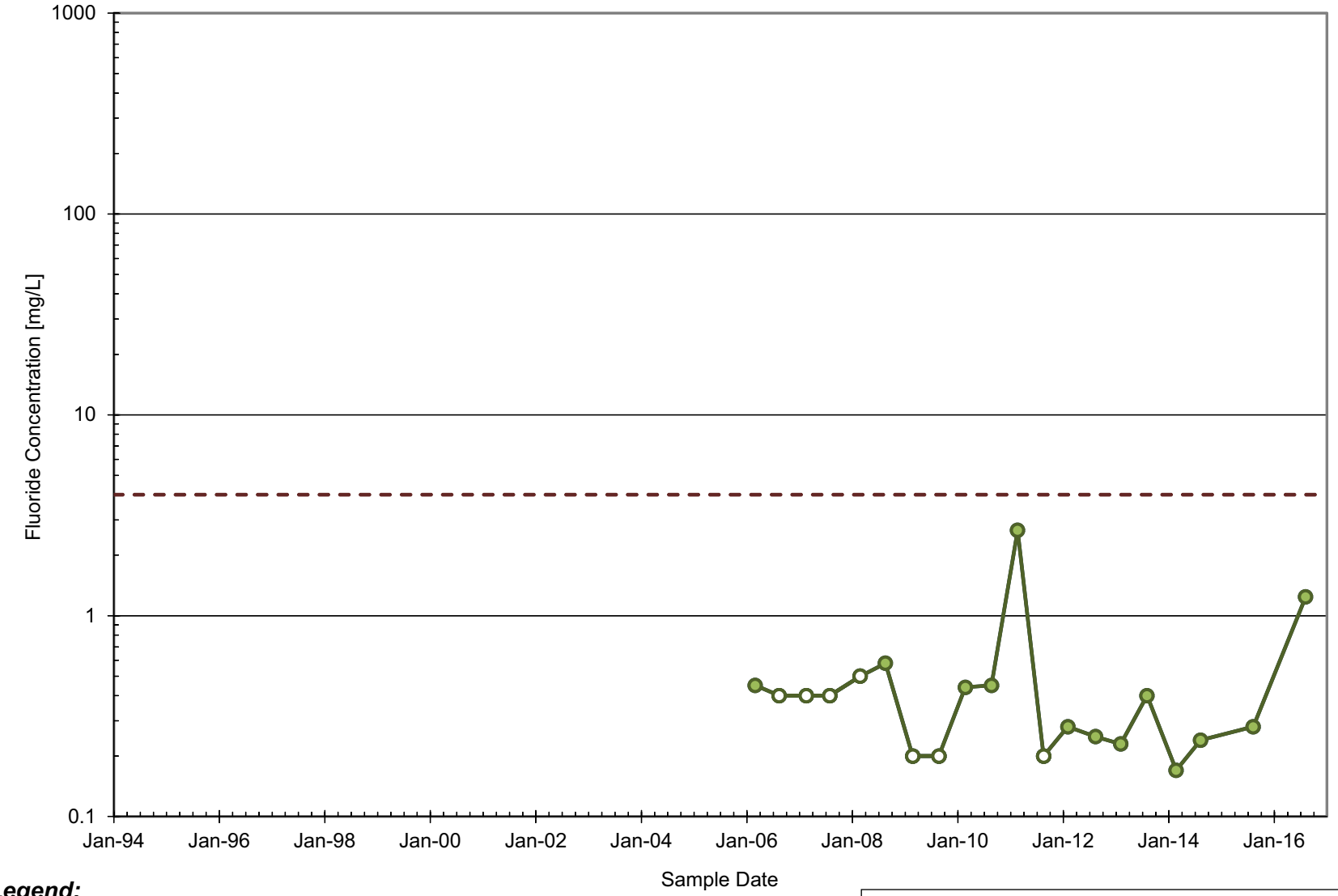
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-59



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

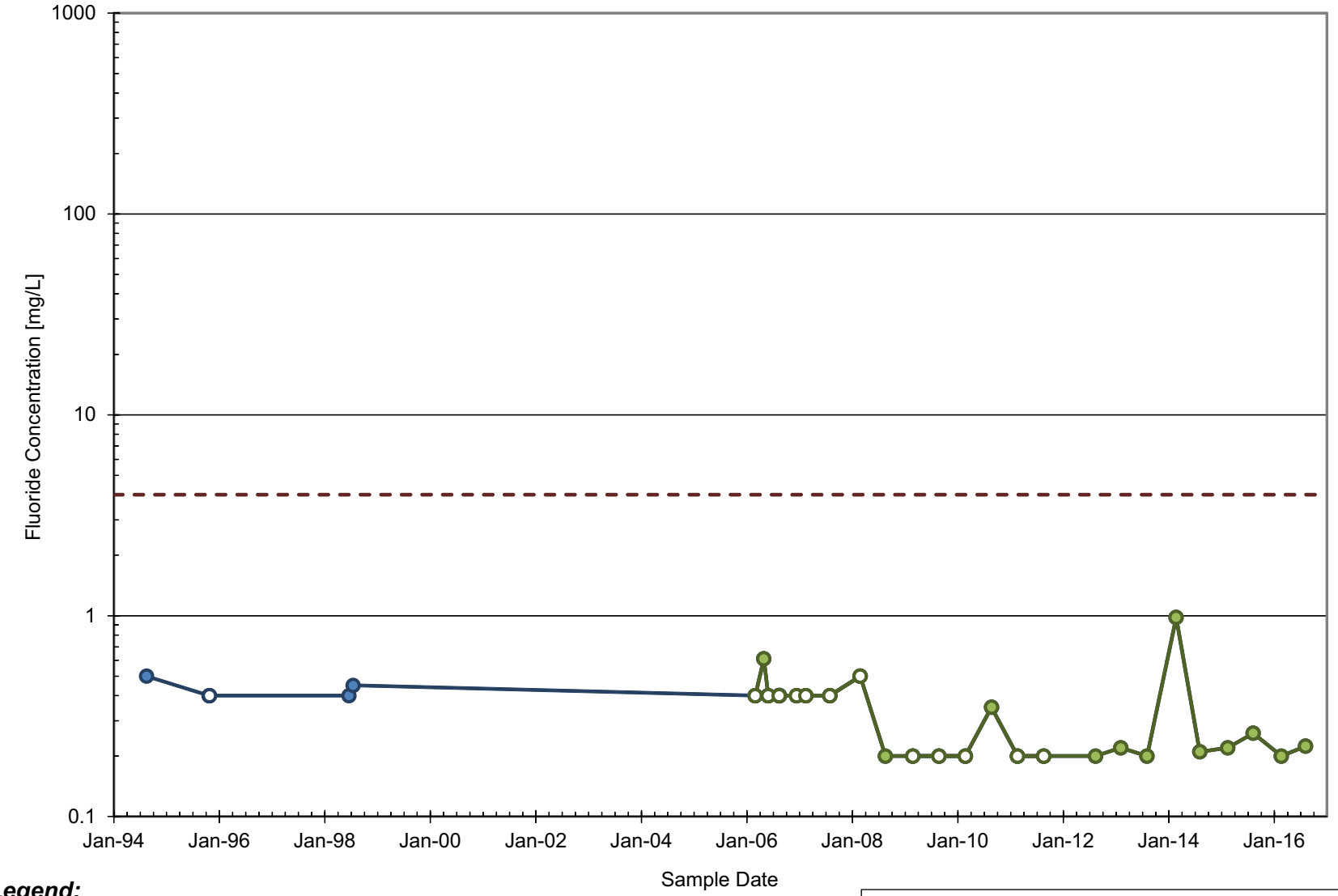
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: PW05

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-60



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

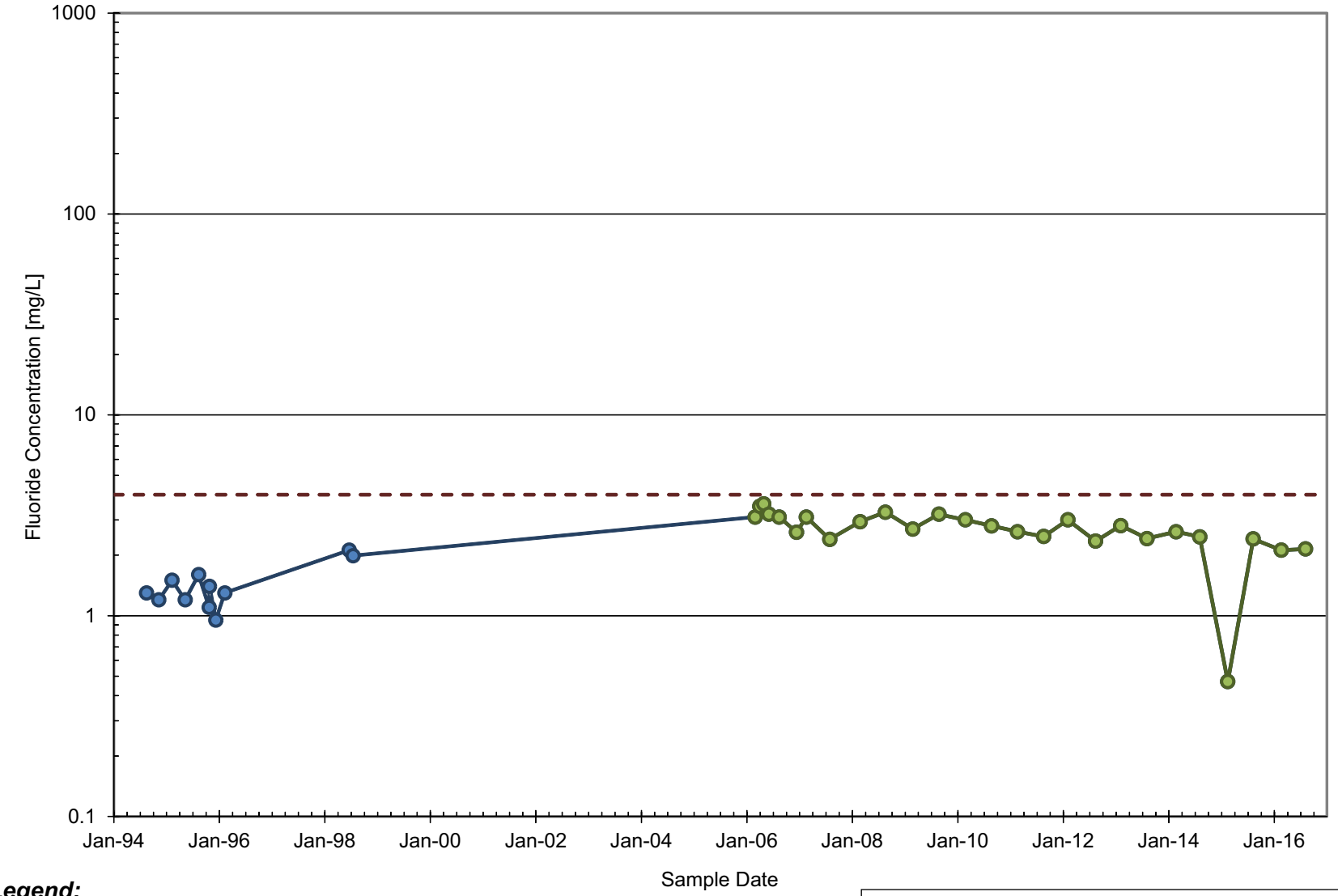
Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: PW07

Troutdale Reynolds Industrial Property - 2016 Annual Report
Port of Portland
Troutdale, Oregon

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1069-70	Figure
January 2017		B-61



Legend:

Fluoride Concentration in mg/L (Pre-System): Open = Non-Detect

Fluoride Concentration (After FE/PWO System Startup): Open = Non-Detect

Fluoride MCL (4 mg/L)

Fluoride Concentration Trend: PW08

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Apex Companies, LLC
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Portland, Oregon 97201

Project Number	1069-70	Figure
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